Legal Frameworks and the use of Science in Regional Fisheries Management Organisations

by

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David Midson

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Abstract

This thesis compares the role of science in the decision making processes and legal frameworks of a selection of Regional Fisheries Management Organisations (RFMOs) in order to understand the features of those frameworks which influence their use of science.

The RFMOs analysed are the six largest non-tuna RFMOs, the:

- Commission for the Conservation of Antarctic Marine Living Resources,
- South East Atlantic Fisheries Organisation,
- General Fisheries Commission for the Mediterranean,
- Northwest Atlantic Fisheries Organization,
- North East Atlantic Fisheries Commission, and
- South Pacific Regional Fisheries Management Organisation.

Each of these RFMOs enshrines science as the key input into fisheries management. However the thesis shows that there are variations between them regarding the consistency with which they followed the advice of their scientific advisors. These variations have enabled a comparison of both the legal frameworks and the decision making records of each body.

The thesis submits that both the ability of the decision maker to take decisions in the absence of scientific consensus (or in the face of scientific uncertainty) and, transparency in the decision making process, are important factors which increase the effectiveness of the use of science in the decision making process.

The comparative analysis conducted in the thesis has allowed the suggestion of modifications that could be made to RFMO legal frameworks in order to strengthen the ability of scientific advisors to provide salient advice, thereby improving quality and transparency in decision making processes.

Abbreviations

RANs	Resource Adjacent Nations
DWFN	Distant Water Fishing Nations
NPFC	The North Pacific Fisheries Commission
IPHC	International Pacific Halibut Commission
IATTC	Inter-American Tropical Tuna Commission
CCSBT	Commission for the Conservation of Southern Bluefin Tuna
FFA	Fisheries Forum Agency
TAC	Total Allowable Catch
MTAC	Multi-Species Total Allowable Catch
UNCED	United Nations Conference on Environment and Development 1992
FAO	the Food and Agriculture Organization of the United Nations
COFI	the FAO Committee on Fisheries
ICES	International Council for Exploration of the Sea
IPOA	International Plan of Action
ICCAT	International Commission for the Conservation of Atlantic Tunas
IUU	Illegal Unreported and Unregulated Fishing
RFMO	Regional Fisheries Management Organisation

RFB	Regional Fisheries Body
NGO	Non-Government Organisations
MPA	Marine Protected Area
MSY	Maximum Sustainable Yield
CCAMLR	Convention for the Conservation of Antarctic Marine Living Resources
SEAFO	South East Atlantic Fisheries Organisation
GFCM	General Fisheries Commission for the Mediterranean
NAFO	Northwest Atlantic Fisheries Organization
NEAFO	North East Atlantic Fisheries Organisation
SPRFMO	South Pacific Regional Fisheries Management Organisation

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Chapter 1

Introduction

Marine capture fisheries have been managed with the aim of sustainable use for many years yet they remain in decline. The 2016 FAO State of World Fisheries Report estimated that 68.6% of stocks were fished within sustainable levels in 2013, down from 90% in 1970.[1] In the same period the total take from marine capture fisheries also declined by approximately six million tonnes.[2] When both sustainability and production are falling fisheries management is not succeeding. In late May 2016, delegates from around the world met in New York to face this challenge and resume the Review Conference of the *United Nations Convention on the Law of the Sea of 10 December 1982 relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks*.[3] The Conference focused on Regional Fisheries Management Organisations (RFMOs) and the changes needed for those organisations to successfully manage fish stocks.[4] In their discussions several of the delegates concluded that one of the most important changes needed was to improve the effectiveness of RFMO decision making frameworks.[5] The delegates noted the need to improve the interface between science and policy, finding that:

> Communication between the science and policy communities [is] important for successful resource management" and, "there [is] a wide variation in how RFMO's incorporate the science-policy interface.[6]

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[1] The Food and Agriculture Organization, *The State of World Fisheries and Aquaculture 2016 - Contributing to food security and nutrition for all* (The Food and Agriculture Organization, 2016), 38.
[2] Ibid, 38.
[3] F. Hazin, 'Advance and unedited report of the resumed Review Conference on the Agreement for the Implementation of the Provisions of the United Nations Convention on the Law of the Sea of 10 December 1982 relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks' (The United Nations, 23-27 May 2016) <http://www.un.org/Depts/los/convention_agreements/fishstocksmeetings/Adv_ICP_ResumedReviewConference2016.pdf>.
[4] Ibid, para 27-28.
[5] Ibid, para 110.
[6] Ibid, para 89.

Following this discussion, the Conference recommended that States:

> Strengthen interaction between fisheries managers and scientists, and other stakeholders, to ensure that conservation and management measures are based on the best available scientific evidence and meet the management objectives set by the regional fisheries management organization/arrangement, through a regular review process, taking into account the adverse impacts of climate change and ocean acidification.[7]

The recommendations and reported discussions of the Conference highlight the need for continued adjustment of best-practice guidelines to support reviews of RFMO operations and the creation of new RFMOs.[8]

This thesis assists with this task by analysing the interactions between scientific advisors and decision making bodies in light of the different legal frameworks which support that interaction. This is done in order to understand the factors that assist in improving the utilisation of scientific advice within RFMO decision making processes. It is not intended that this study be a critique of the legal framework or the decision making policy of any particular RFMO, as there have been several such reviews undertaken previously.[9] Rather the aim is, through the comparative analysis, to identify to variations in legal frameworks which correlate with more effective use of science for decision making.

A review of the literature on the interface between science, policy and decision making is included in this chapter and chapter two, in order to identify features which have been found to have a positive influence on the effective use of science in decision making. Having a knowledge of these factors enables a discussion of why certain features of legal arrangements correlate to more

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[7] Ibid, para A14.
[8] Ibid, para 101.
[9] See, for example, the comprehensive review by Chatham House - M. Lodge et al, 'Recommended Best Practices for Regional Fisheries Management Organisations: Report of an independent panel to develop a model for improved governance by Regional Fisheries Management Organizations' (Chatham House, 2007) <https://www.oecd.org/sd-roundtable/papersandpublications/39374297.pdf>.

effective use of science in decision making. This in turn may contribute to the development of best-practice for legal frameworks that support the interface between science and decision making.

The RFMOs have been selected as tools to be used to uncover the underlying features of legal frameworks that promote or hinder the effective use of science. A search of the literature has not uncovered any previous attempts to use a comparison of RFMO decision making reporting as a tool to analyse the effectiveness of the legal frameworks underpinning regional fisheries management. It is therefore hoped that this study will contribute to the broader understanding of what makes an RFMO legal framework effective and suggest a possible method for analysing those frameworks that can be built on and perhaps incorporated into future RFMO reviews.

The History and Context of Human Exploitation of Fish Stocks

Humans have exploited fish for thousands of years.[10] Humans were hunters and gatherers, and while on land hunting and gathering has been largely replaced by agriculture, the ocean has remained a place where it is the predominate form of exploitation.[11] Yet despite our long history of utilising fish stocks, our attempts to conserve and sustainably manage the resource have often been unsuccessful.

Our ability to harvest fish has, on the other hand, been very successful, and in 2014 marine capture fisheries produced 81.5 million tonnes.[12] The global fishing effort provides (along with aquaculture) many people with a large proportion of their diets' animal protein. For example, in 2014 fisheries produced an estimated 20kg of food fish per person and supplied an average of 17% of the human daily animal protein intake.[13] For many people wild fish are the only source of protein

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[10] T. Pitcher, 'Fisheries Managed to Rebuild Ecosystems? Reconstructing the Past to Salvage the Future' (2001) 11(2) *Ecological Applications* 601-602.
[11] G. Carleton Ray, 'Man and the Sea - The Ecological Challenge' (1985) 25 *American Zoology*.
[12] Organization, above n 1, 4.
[13] Ibid, 3-4.

easily available.[14] Reported figures reveal that on average 15% of people's protein comes from fisheries, a figure that rises to 18.5% for less developed countries.[15] Fish, in any diet provide one of the most nutritionally valuable sources of protein and constitute a significant component of food security in many developing States.[16]

The contribution to employment was also large with 56.6 million people employed in the primary fisheries sector in 2014.[17] Fish that are not used for food often provide a valuable trade commodity; and fishing associated industry can create long-term employment for coastal people if stocks are properly managed.[18] Fisheries are a large component of global economic trade with the total value of traded fish products reaching $148 billion USD in 2014.[19] Importantly a large (and increasing) proportion of this trade includes less developed countries, those countries had 54% of traded value in 2014, up from 37% in 1976.[20] Fisheries provide food and income to many of the most vulnerable people on our globe and therefore if fish stocks were diminished these people would suffer severely.[21]

The Future of World Fisheries

In earlier times it was thought that fish stocks were so abundant that they could be harvested indefinitely, an idea that led to centuries of overexploitation of the sea's resources.[22] More recently,

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[14] J. Ziegler, *The Right to Food*, UN GAOR, 59th sess, Agenda Item 105 (b), UN Doc A/59/385 (27 September 2004), 13.

[15] K. Cochrane, W. Emerson and R. Willmann, 'Sustainable Fisheries: The Importance of the Bigger Picture' in W. Taylor, A. Lynch and M. Schechter (eds), *Sustainable Fisheries: Multi-Level Approaches to a Global Problems* (American Fisheries Society, 2011) 3, 3.

[16] T. Daw et al, 'Climate change and capture fisheries: potential impacts adaptation and mitigation' in K. Cochrane et al (eds), *Climate Change and implications for fisheries and aquaculture: overview of current scientific knowledge* (The Food and Agriculture Organization, 2009) 107, 113.

[17] Organization, above n 1, 32.

[18] Daw et al, above n 16, 113.

[19] Organization, above n 1, 52.

[20] Ibid, 55.

[21] J. Ziegler, *The Right to Food*, UN GAOR, 59th sess, Agenda Item 105 (b), UN Doc A/59/385 (27 September 2004), 13.

[22] W. Nichols, J. Seminoff and P. Etnoyer, 'Biodiversity, Function, and Interconnectedness: A Revolution in Our Understanding of Marine Ecosystems and Ocean Coservation' in Grafton R. Q. et al (eds), *Handbook of Marine Fisheries Conservation and Management* (Oxford University Press, 2010) 43, 43 and 51.

in the second half of the 20th century, it was still believed that the harvest of fish could grow nearly indefinitely a belief fuelled by increasing total landed weights.[23] Today researchers are increasingly fearful that the our exploitation have depleted many fish stocks beyond recovery with some are already down to levels as low as 1% of the pre-exploitation population.[24] For up to 50% of other stocks there is a great deal uncertainty, in these cases the current population, or estimated pre-exploitation population is unknown, and therefore no objective sense of the impact of fishing can be determined.[25]

In a landmark 1998 article, Pauly *et al* described the practice of fishing down marine food webs. That is, fishing out a predator, and when the prey species becomes more abundant because of less predation, fishing out the prey species. This practice continues down the food web, targeting less and less (commercially) desirable species.[26] This behaviour suggests that rather than being used in a sustainable and renewable way, the oceans are being mined, from the top of the food web down to the bottom.[27] This can have evolutionary consequences when the human exploitation is of such a scale that it creates selective pressure for the evolution of fish populations that are composed of smaller and smaller individuals, which are consequently less desirable for human consumption.[28]

Overexploitation of fish stocks has a variety of causes; over capitalisation of fleets, social and political pressure to fish more, poor decision making, and population growth.[29] While there have been many drivers of exploitation it has been technological advances that have enabled it. Technology has allowed fisher folk to reach ever more of the world's oceans, and over the last 50

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23 D. Pauly et al, 'Fishing Down Marine Food Webs' (1998) 279 *Science* 860, 860.
24 K. Gjerde, 'Editor's Introduction: Moving from Words to Action' (2005) 20(3-4) *The International Journal of Marine and Coastal Law* 323, 327.
25 Ibid, 327.
26 Pauly et al, above n 23, 861-862
27 Ibid, 860-862.
28 Pitcher, above n 10, 604-605.
29 M. Schechter and D. Blue, 'The Inadequacy of Contemporary International Governance of Fisheries Ecosystems' in W. Taylor, A. Lynch and M. Schechter (eds), *Sustainable Fisheries: Multi-Level Approaches to a Global Problem* (American Fisheries Society, 2011) 229, 232-234.

years, fishers have been enabled to exploit species in a vast amount of the ocean.[30] Fortunately technological developments have also supported efforts at sustainability by helping fishermen to minimise bycatch, with new bycatch minimising nets and devices, and, in assisting governments to enforce fisheries regulations, with the use of technology such as vessel satellite monitoring.[31]

Environmental changes have made the oceans more susceptible to exploitation. The most widespread environmental change to affect fish stocks is climate change. The existence of climate change is now widely accepted, as is the fact that climate change will have broad and unpredictable impacts on marine ecosystems.[32] Climate change is having a physical impact on ocean: currents, evaporation, temperature and chemical composition.[33] Given this physical impact, there is a high likelihood that climate change will modify the distribution of species, affect fish physiologically and affect the distribution of species.[34]

The effects of climate change on fish stocks will be varied. The biological or ecological impact of climate change will depend on the rate of change and the sensitivity to change of the ecosystem in question. Clearly, if change is too abrupt, species or ecosystems may not be able to adapt quickly enough leading to negative consequences for those species and ecosystems.[35] Some of the world's largest and most productive marine ecosystems based on ocean upwellings or convergences (such as the Humboldt Current off Peru, the Gulfstream upwelling off the North American Atlantic Coast and the Agulhas Bank off the coast of southern Africa) are potentially the most affected. The productivity of these systems rely on the large scale ocean currents that carry the nutrients

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[30] D. Pauly et al, 'The Future for Fisheries' (2003) 302 *Science* 1359, 1359.
[31] S. Garcia and R. Grainger, 'Gloom and doom? The future of marine capture fisheries' (2005) 360 *Philosophical Transactions of the Royal Society* 21 28, 33.
[32] K. Cochrane et al, 'Climate change implications for fisheries and aquaculture: overview of current scientific knowledge' (The Food and Agriculture Organization, 2009), 1-5.
[33] Ibid, 2.
[34] Ibid, 2-3.
[35] K. Brander, 'Climate Change and Fisheries Management' in Grafton R. Q. et al (eds), *Handbook of Marine Fisheries Conservation and Management* (Oxford University Press, 2010) 123, 125-127.

across ocean basins and around the world.[36] In turn these large currents are highly dependent on climate factors, and many are particularly reliant on very cold water created at the poles.[37] This very cold water sinks to the bottom of the ocean, full of nutrients, before travelling across the ocean basin to rise and reappear at upwelling sites.[38] Given this temperature sensitivity, the currents and the upwellings they create are sensitive to climate change.[39] In some cases climate change may stop upwellings, destroying the dependent fishery, in other cases the nutrients and productivity could move. While the exact effect of climate change will be different for each fish stock it is highly likely that increasing variation in global climate will lead to increasing variation in the yield of fish stocks.[40] In order to deal with the unpredictable effects of climate change, fishery managers will be required to continually monitor management measures to ensure they reflect the changing state of climate effected ecosystems.[41] It will be crucial that management frameworks for the setting of catch limits and other conservation measures are flexible enough to take into account dramatic environmental changes in both setting total catch and allocating that catch amongst competitors.[42]

In many cases overexploitation is due to a lack of effective (or in some cases any) management.[43] This lack is particularly acute on the high seas and for those straddling and migratory fish stocks, which being outside the control of any one State, can suffer from an archetypal tragedy of the commons. Where there is no, or inadequate, management, profound damage can be done to both the ecosystem and fish stock.[44] The damage done not only denies existing communities the benefit of the fishery but also denies it to future generations.[45] The primary solution adopted by

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[36] Daw et al, above n 16, 126.
[37] Ibid, 126.
[38] Ibid, 124.
[39] Ibid, 124.
[40] Brander, above n 35, 127.
[41] Ibid, 132-133.
[42] Daw et al, above n 16, 141.
[43] The Food and Agriculture Organization, 'Fisheries Management' (FAO Technical Guidelines for Responsible Fisheries, No 4, The Food and Agricultural Organisation, 2007), 6.
[44] Ibid, 40-44.
[45] Ibid, 44.

international law for this is for States to join together and manage fish stocks on a regional basis. This solution is enunciated in the *1995 Agreement for the Implementation of the Provisions of the United Nations Convention on the Law of the Sea of 10 December 1982 Relating to the Conservation and Management of Straddling Fish Stock and Highly Migratory Fish Stocks* (UNSFA) which puts RFMOs at the heart of fisheries management.[46]

Importance of the Relationship between Science and Decision Making

The UN Secretary-General stated that "[m]arine science is an essential underpinning for the sustainable management of the oceans and their resources" and that "the effectiveness of fisheries management is dependent on the extent to which it is informed by an accurate understanding of [fisheries science]".[47] If fisheries science is the key to effective management of fisheries, improving the utilisation of fisheries science is a logical solution to improving outcomes for fish stocks.[48] The role of science in providing for sustainable fisheries has long been recognised and discussed.[49] Lane and Stephenson identified the inability of the science-management interface to deal with uncertainty or to meet multiple objectives as being a primary cause of ineffective fisheries management.[50] At the 2010 Review Conference on the Fish Stocks Agreement many States suggested that one of the most important reasons that migratory and straddling fish stocks had not recovered in the 2006-2010 period was that RFMO's failed to follow scientific advice to reduce catches.[51] Many delegations to the resumed Review Conference in 2016, reflecting on the

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[46] Lodge et al, above n 9, v; *Agreement for the Implementation of the Provisions of the United Nations Convention on the Law of the Sea of 10 December 1982 relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks* opened for signature 4 August 1995, 2167 UNTS 3 (entered into force 11 December 2001) ('*UNFSA*').
[47] *Oceans and law of the sea–Report of the Secretary-General*, UN GAOR, 65th sess, Agenda Item 75 (a), UN Doc A/65/69 (29 March 2010), 21.
[48] D. Lane and R. Stephenson, 'A framework for risk analysis in fisheries decision-making' (1998) 55 *ICES Journal of Marine Science* 1, 1 and 13.
[49] S. Garcia, 'Fishery Science and Decision Making: Dire Straits to Sustainability' (2005) 76(2) *Bulletin of Marine Science* 171, 171-172.
[50] Lane and Stephenson, above n 48, 1.
[51] D. Balton, 'Report of the resumed Review Conference on the Agreement for the Implementation of the Provisions of the United Nations Convention on the Law of the Sea of 10 December 1982 relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks' (August

discussions of 2010, expressed disappointment that the status of fish stocks had not improved and that many of the recommendations from the previous conference not yet implemented.[52]

The Food and Agricultural Organisation (FAO) has stated that the primary role of fisheries institutions is to identify and implement rules and procedures so that the fishery can be carried out in a sustainable way.[53] Success in conserving or restoring marine ecosystems relies on the ability of scientists, managers, fishermen and stakeholders to collaborate and communicate with each other and their stakeholders.[54] It is increasingly clear that a collaborative, interdisciplinary, approach which takes full advantage of multiple forms of knowledge (but in particular the effective integration of scientific advice into political and managerial decision making) is the surest way to adapt to the challenges that fish stocks face.[55] There have been numerous calls for more effective integration of science into decision making processes but this integration continues to be ineffective and unsatisfactory.[56] The integration of science into fisheries management is achieved within a governance framework that guides the interaction and coordination between different types of knowledge, different decision makers, different stakeholders and other fisheries management entities.[57] In this coordination role the governance framework is vital for ensuring

2010) <http://www.un.org/depts/los/convention_agreements/reviewconf/review_conference_report.pdf>, 8.

52 Hazin, above n 3, paras. 23-24.

53 The Food and Agriculture Organization, 'Fisheries Management' (FAO Technical Guidelines for Responsible Fisheries, No 4, The Food and Agricultural Organisation, 2007) 22.

54 Nichols, Seminoff and Etnoyer, above n 22, 52-54.; the ultimate decision-making authority remains with the States which makes up RFMOs and therefore the success of fisheries management ultimately depends on the political will of those States. In chapter 7 the ability of science to impact the political objectives of States will be discussed further.

55 Ibid, 52-54.

56 A. Lynch et al, 'Sustainable Fisheries: Addressing a Global Problem' in W. Taylor, A. Lynch and M. Schechter (eds), *Sustainable Fisheries: Multi-Level Approaches to a Global Problem* (American Fisheries Society, 2011) 11, xvii.

57 S. Garcia, 'Governance, Science and Society: The Ecosystem Approach to Fisheries' in Grafton R. Q. et al (eds), *Handbook of Marine Fisheries Conservation and Management* (Oxford University Press, 2010) 87 21, 90-91.

that effective management occurs.[58] For fisheries management the governance framework consists of a number of multilateral legal agreements.[59]

Importance of Legal Structures for Decision Making in Fisheries Management

Throughout the literature on strengthening regional fisheries management, the legal frameworks underpinning RFMOs are identified as one of the most important contributing factors to sustainable fisheries. Martens *et al* states:

> The fundamental source of [unsustainable fisheries] lies in the institutional arrangements that govern many fisheries, especially those found in the oceans. Weak fisheries management regimes induce fishery resources to be harvested by excessive fishing.[60]

International legal structures have a central role in fisheries management: first, in ensuring the appropriate coherent management of international stocks, secondly, by ensuring that fisheries management is consistent with the broader aims of oceans management and thirdly, to structure relationships between different sectors and stakeholders.[61] International integration and coherency in fisheries management is vital for many reasons, including the increasing globalisation and connectedness of markets and the inherent connectedness of marine ecosystems.[62]

At the regional level this is primarily achieved by RFMO's. These are the institutions that form a bridge between the aspirational goals of multinational agreements and day-to-day fisheries management.[63] However, there is a perception that RFMO's: are: failing to make decisions properly, not properly taking into account science, not making timely decisions, and, often making

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[58] Ibid, 90-93.
[59] Ibid, 90-93.
[60] O. Martens et al, 'Banking on Sustainable Fisheries' in W. Taylor, A. Lynch and M. Schechter (eds), *Sustainable Fisheries: Multi-Level Approaches to a Global Problem* (American Fisheries Society, 2011) 281, 282.
[61] L. Ridgeway and J. Rice, 'International Organizations and Fisheries Governance' in Grafton R. Q. et al (eds), *Handbook of Fisheries Management and Conservation* (Oxford University Press, 2010) 485, 487-488.
[62] Ibid , 486.
[63] H. Parris, A. Wright and I. Cartwright, 'The Challenge of Fisheries Governance after *UNFSA*: The Case of the Western and Central Pacific Fisheries Commission' in Grafton R. Q. et al (eds), *The Handbook of Fisheries Conservation and Management* (Oxford University Press, 2010) 443, 446.

decisions based on the lowest common denominator.[64] The challenge for RFMOs' is to have a legal framework in place that respects State sovereignty while ensuring that the best management decisions are made.[65]

Within RFMOs (as in many other areas) is a role of legal structures to mediate scientific knowledge with other forms of knowledge so that the most effective risk regulation can take place.[66] However, before legal structures can be modified to more effectively support that mediation, the nature and characteristics of scientific information and its interaction with decision making must be understood.

The Nature of Science

Science is the defining source of knowledge of the modern age; it holds a pre-eminent position as a method of understanding our world and as a source of information for decision making. Scientists play a decisive role in the decision making process because it is scientists, as apolitical professionals, who translate the facts for the decision maker and hence frame the decision making process.[67] While science is an important resource for decision makers, it has often been described (by decision makers) as poorly suited to interaction with political decision making frameworks.[68]

The scientific method is the name given to the way scientists answer questions about the world. The tools used within this method include experimentation, observation and modelling, with the results obtained by these tools analysed using scientific reasoning. The reasoning methodologies used include inductive inference and inference of best explanation.[69] Induction is a method of

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[64] T. McDorman, 'Implementing Existing Tools: Turning Words into Actions - Decision-Making Processes of Regional Fisheries Management Organisations (RFMOs)' (2005) 20 *International Journal of Marine and Coastal Law* 423, 425.
[65] Ibid, 426.
[66] J. Peel, *Science and Risk Regulation in International Law,* Cambridge Studies in International and Comparative Law (Cambridge University Press, 2010).
[67] D. Kennedy, 'Challenging Expert Rule: The Politics of Global Governance' (2004) 27(5) *Sydney Law Review* 1, 11.
[68] T. Mills and R. Clark, 'Role of research scientists in natural resource decision-making' (2001) 153 *Forest Ecology and Management* 189, 190.
[69] S. Okasha, *Philosophy of Science: A Very Short Introduction* (Oxford University Press, 2002), 18 and 29.

reasoning whereby a conclusion about an observed object is applied to objects that have not been observed.[70] The second form of inference is the inference of best explanation. In this form the scientist draws an inference that is the most likely conclusion from a given set of facts; an example of which is Darwin's theory of evolution.[71] Both types of inference allow scientists to make predictions about the future, but using inference creates some fundamental limitations for science. First, inferences do not prove absolutely what is true and it is therefore always possible that the science could be wrong, no matter how many hours of research have been devoted to the issue.[72]

Kuhn, in his classic work, *The Structure of Scientific Revolution*, said that science was based around paradigms and that the history of science could be separated by periods of 'revolution' where paradigms were changed.[73] Examples of revolutionary paradigm shifts include, the theory of evolution from Darwin, or the theory of general relativity from Einstein.[74] The changing paradigms of scientific history show that science is influenced by the accepted scientific understanding, methods and culture of the time. Additionally, they show that during a period of scientific revolution, previously strongly held scientific convictions can be quickly overturned.

Uncertainty and Tentativeness

The ability to change previously held views is a necessary part of science because the scientific method is based on probability not certainty. Science examines data and makes an assessment about the likelihood of different explanations for that data.[75] This means that science can only say that something is probable and never that it is absolutely certain.

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[70] Ibid, 18-20.
[71] Ibid, 31.
[72] P. Anand, 'Decision-Making When Science Is Ambiguous' (2002) 295 *Science* 1839, 1839.
[73] T. Kuhn, *The Structure of Scientific Revolutions* (Chicago University Press, 3rd ed, 1962) 99, 92-120.
[74] Ibid, 101-102 and 171-172.
[75] Okasha, above n 69, 33-36.

The scientific community's response to the uncertainty of scientific conclusions is tentativeness.[76] Tentativeness is the characteristic of science to suspend judgement until enough evidence is available to meet the applicable scientific standards of proof.[77] This characteristic is exhibited by scientists who will often not come to a conclusion, or hazard a guess, in situations where the data is not up to the accepted standard within their field. This principle of not being drawn into decisions based on certainty less than scientific proof can make science less effective in assisting decision makers in situations of high uncertainty or complexity.[78] Neither tentativeness nor uncertainty is a problem for scientists as they have ways of communicating both which are understood within their community. However, when science is communicated to non-scientists uncertainty can be a point of misunderstanding and friction.[79] Political and managerial decision makers would often prefer to be able to cite an absolute.[80] In cases of high uncertainty, other forms of knowledge: political, economic or social, may draw upon more by decision makers.[81]

Peel suggests a way of classifying decisions based on interpreting uncertainty into traffic light colours, green, orange and red.[82] The colour green indicates that uncertainty is low and science can play the major role in the decision, the colour orange indicates that there is some uncertainty and other forms of knowledge will need to be involved in the questions, and the colour red indicates that uncertainty is high and science will play a lesser role and other sources of information will have a greater impact on decision making to prevail.[83] Peel provides the example of importing well known and understood invasive species into a country as an example of "green" risk, the science

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[76] G. Aikenhead, 'Collective Decision Making in the Social Context of Science' (1985) 69(4) *Science Education* 453, 463.
[77] Ibid, 463.
[78] Ibid, 464-466.
[79] P. Ehrlich and G. Daily, 'Science and the Management of Natural Resources' (1993) 3(4) *Ecological Applications* 558 73, 559.
[80] C. Epstein, 'Knowledge and Power in Global Environmental Activism' (2005) 10(1) *International Journal of Peace Studies*, 59-60.
[81] Peel, above n 66, 86-87.
[82] Ibid, 380-382.
[83] Ibid, 380-382.

is well understood hence there is little political opposition to following scientific advice.[84] As an example of "red" risk she offers the example of the governance of genetically modified organisms, where the science is not well understood and decision makers find themselves drawing from other sources of information to support their points of view.[85]

Objectiveness

Scientific positivists have argued that science is inherently objective and that this objectivity has been vital to its value as a decision making input.[86] But in many circumstances the idea that science is politically or even ethically neutral is a myth.[87] Public inquiries have found scientific experts to have ideological, financial, political and ethical biases that influence their professional judgment.[88] It has also been shown that scientists are heavily influenced by biases from their training.[89] In recent times as scientists have been increasingly involved in political advocacy, particularly around environmental issues, and they have not distinguished between their scientific advice and policy views.[90] Being able to clearly distinguish between policy recommendations and scientific advice is vital for science to legitimately claim its independence, which in turn is required for convincing those who make policy decisions.[91]

A lack of objectivity in science is not only a result of political activism, it is inherent in the conduct of science and removing it completely is unachievable.[92] It is unachievable because scientists have to make a range of choices based on factors other than data. For example they have to decide which data to collect, where to look and what questions to ask, all these decisions allow subjectivity

84 Ibid, 380-382.
85 Ibid, 380-382.
86 Ibid 62, 66 and 94.
87 Aikenhead, above n 76, 456-457.
88 Ibid, 457.
89 Ehrlich and Daily, above n 79, 458.
90 R. Lackey, 'Science, scientists, and policy advocacy' (2007) 21(1) *Conservation Biology* 12, 13-14.
91 D. Policansky, 'Science and Decision Making for Water Resources' (1998) 8(3) *Ecological Applications* 610, 616-617.
92 Okasha, above n 69, 129-133.

to impact the science.[93] Subjectivity can occur across entire fields of inquiry. Science is not created in a void, it occurs in a world where there are scientific concepts, methods, beliefs and assumptions (together being a paradigm as discussed above) shared among scientists.[94] Akienhead describes it as "science having its own set of values which, like a constitution, guide scientists when they decide between competing theories or experimental methodologies."[95] A paradigm shapes the way scientists conduct their research, it shapes the methods they use, the assumptions they make about the data and even the questions they ask.

The Relationship between Science and Management

Science can, if properly utilised, assist decision makers with; problem perception, scope, mechanistic understanding, identification of cause and effect, and most usefully assessment on the effect of different courses of action.[96] Science has been a tool for greater participation in environmental decision making. It is a medium that non-government organisations (NGOs) have used to impact the environmental law making process.[97] Science has been used to reach agreement between politically disparate decision makers.[98] Science can be used this way because there is a higher likelihood of scientists from different countries being able to engage in decision making within an agreed context (of science) than there is of politicians engaging in a similarly agreed context.[99] Despite the many benefits of using science in decision making it risks being marginalised if the relationship between science and policy is not managed correctly.[100] Science loses its value if

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[93] Ibid, 129-133.
[94] Kuhn, above n 73, 43-51.
[95] Aikenhead, above n 76, 457.76
[96] Ehrlich and Daily, above n 79, 559.
[97] Epstein, above n 80, 49.
[98] L. Conradt and T. Roper, 'Consensus decision making in animals' (2005) 20(8) *Trends in Ecology and Evolution* 449, 454.
[99] Peel, above n 66, 287-290.
[100] Lackey, above n 90, 12.

decision makers use it as a cloak for what are in reality political decisions, likewise, scientists can sabotage their credibility if they espouse their personal views cloaked in science.[101]

Studies which have examined the influence of science on decision makers have shown that to be effective science must be seen as salient, credible and legitimate.[102] To be salient science must be both relevant and communicated in a relevant way to decision makers.[103] To be credible, science must be seen as accurate, trustworthy and free from bias.[104] Importantly, when science is aimed at decision makers it does not just have to be credible to other scientists, but also credible to the decision making audience.[105] To be legitimate it must be perceived to have taken into equal account the values, concerns and perspectives of the relevant stake holders.[106]

Salience

The term salience refers to the relevance of the scientific advice to the decision to be made. Science must be tailored to the needs of the decision makers and answer the questions that they need to be answered, in order to make the decision.[107] Information must be on the correct scale both geographically and temporally, for example information at a global level may not be useful for local decision making.[108] Likewise scientific advice must be able to support decisions on future courses of action.[109] Salience can be improved by a consultative approach.[110] In this approach decision makers are consulted early and often as to what questions they have, and what their needs are, so

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[101] Ibid, 12.
[102] W. Clark, R. Mitchell and D. Cash, 'Evaluating the Influence of Global Environmental Assessments' in R. Mitchell et al (eds), *Global Environmental Assessments: Information and Influence* (MIT Press, 2006), 15.
[103] Ibid, 15.
[104] Ibid, 13.
[105] Ibid, 13.
[106] Ibid, 15.
[107] Ibid, 15.
[108] Ibid, 16-17.
[109] D. Boesch, 'The role of science in ocean governance' (1999) 31 *Ecological Economics* 189 132, 195.
[110] S. Maasen and O. Lieven, 'Transdiscipinarity: a new mode of governing science?' (2006) 33(6) *Science and Public Policy* 399, 406-409.

that the science can be tailored, not in the substantive results, but in the form that the results are communicated in.

Credibility

The results that science produces can increase both its credibility and legitimacy.[111] Where scientific advice has a reputation for leading to the desired results being achieved, then its influence will increase.[112] Credibility that comes from effectiveness will be most valuable where matters are not value laden. In highly political or controversial situations, effectiveness does not greatly influence the credibility of science.[113]

Legitimacy

Legitimacy can be increased by such diverse factors as participation, expertise, transparency and independence.[114] When science has all these attributes it will be more influential and therefore it will make a more effective input into decision making.[115] The assertion that science is apolitical has given it legitimacy in international law making; the objective nature of science has enabled it to influence decisions in a way that is not directly politically attackable.[116] Scientific knowledge has, however, for a number of reasons, lost legitimacy in the view of the general population and consequently the need to bolster its legitimacy has increased.[117]

The number and variety of stakeholders that have a say in science increases its legitimacy by making the science more democratic.[118] Conversely, others believe that democracy weakens the science, as they believe that scientific methodologies can only be assessed properly by other scientists.[119]

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111 Clark, Mitchell and Cash, above n 102, 13-16.
112 D. Bodansky, 'The Legitimacy of International Governance: A Coming Challenge for International Environmental Law' (1999) 93(3) *The American Journal of International Law* 596 126, 612.
113 Peel, above n 66, 39-40.
114 Clark, Mitchell and Cash, above n 102, 19.
115 Ibid, 19.
116 Peel, above n 66, 64-72.
117 Ibid, 38-40.
118 Ibid, 103.
119 Ibid, 103.

Increased participation can also slow the process and when coupled with the requirements of consensus decision making the process of producing science can be stalled.[120] Several commentators have suggested methods to making decision making more democratic while avoiding these pitfalls. Peel suggests that instead of increasing the input of stakeholders into the process of making science, it is preferable to allow increased input into the political decision making process, thus giving the overall process greater legitimacy, without compromising the science.[121] From a practical perspective, increased participation has limitations given the sometimes onerous financial, administrative and logistical requirements. Therefore it is likely that public participation could only be meaningfully achieved through NGOs or other interest groups.[122] Another potential solution is "negotiated science", where scientists from many backgrounds negotiate the scientific advice, thus democratising the science itself.[123] While there are practical limitations in crafting democratic science it has also been shown that decision makers view science as legitimate when it is made through a process of cooperation, either within the scientific community or with other stakeholders.[124] Cooperation gives all those involved a sense of ownership over the process and the outcome and therefore increases the likelihood that the scientific advice will be followed.[125]

Independence can increase the perceived legitimacy of science in both decision makers and stakeholders and has been shown to increase the value of science in a number of ways.[126] Independent, and thus objective, science more readily crosses political divides.[127] It has been

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[120] Epstein, above n 80, 57.
[121] Peel, above n 66, 336.
[122] Bodansky, above n 112, 619.
[123] See for example K. Backstrand, 'Civic Science for Sustainability: Reframing the Role of Experts, Policy-Makers and Citizens in Environmental Governance' (2003) 3(4) *Global Environmental Politics* 24, 28-29.
[124] Clark, Mitchell and Cash, above n 102, 19.
[125] Ibid, 19-20.
[126] A. Grunwald, 'Scientific independence as a constitutive part of parliamentary technology assessment' (2006) 33(2) *Science and Public Policy* 103, 105.
[127] Ibid, 105.

observed that negotiations within the scientific community are more likely to reach consensus in a progressive manner even in politically charged situations.[128] Conversely, a lack of independence can limit the effectiveness of science. An example of this is whaling, where early cetacean scientists depended on whaling companies for funding and information, limiting their credibility and effectiveness.[129]

Unfortunately, science rarely achieves the ideal of independence, and political influence will often limit the effectiveness of the scientific process.[130] Independence can be compromised when science mixes with legal and political structures when adversarial practices are included in the decision making framework.[131] However, it is important to recognise that decision making is often political and that science must interact with politics if it is to influence those decisions. Therefore a balance must be struck between influence and independence.[132] To strike this balance, decision makers should be encouraged to have input into both the questions that are asked, and the process of answering those questions, but not be allowed to influence what the answers are.[133]

The impact of the utilisation of other forms of knowledge on the effectiveness of science

Science is often held up as a pinnacle of knowledge, and scientific evidence has often been accepted without question by non-scientists.[134] Indeed many scientists share the opinion that it is they whom are best placed to talk about the implementation of policy on issues that are scientific in nature.[135] While science is a powerful tool that has provided many benefits for society it has also been known to get things wrong, for example, by declaring the oceans to be inexhaustible.[136] Unfortunately,

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128 Boesch, above n 109, 195-196.
129 Epstein, above n 80, 59-60.
130 Peel, above n 66, 64-66 and 93-99.
131 D. Burk, 'When Scientists Act Like Lawyers: The Problem of Adversary Science' (1993) 33 *Jurimetrics Journal* 363, 368-370.
132 Clark, Mitchell and Cash, above n 102, 13-16.
133 Ibid, 13-16.
134 Okasha, above n 69, 121.
135 H. Browman and K. Stergiou, 'Politics and socio-economic of ecosystem-based management of marine resources' (2005) 300 *Marine Ecology Progress Series* 241.
136 Okasha, above n 69, 121.; Nichols, Seminoff and Etnoyer, above n 22, 43.

scientists can negatively influence the ability of people to have a say in important debates.[137] Experts can shape the context of the debate, they can formulate the questions and the range of answers available for decisions-makers and as scientific experts they also impart scientific terminology into the decision making process.[138] Indeed scientific consensus, when aired publicly, can actually limit the decision options for political decision makers as the public are reticent to go against the advice of the scientist. It is therefore important to examine whether science should occupy a position of primacy, excluding other sources of knowledge, or whether decision making structures should include those forms of knowledge in the decision making process.[139]

Science is not infallible, nor is it the only way, or even the best way, of understanding all aspects of very complicated issues.[140] There is a role for many different forms of expertise in coming to an informed decision. Accordingly, social researchers and economists are needed to understand the human dimensions of a problem, politicians make value decisions on behalf of the community or their party, and lawyers can apply the current legal regime to the present circumstances.[141] Perhaps the best known doctrine of non-scientific input into environmental decision making is the use of the precautionary principle.[142] The precautionary principle, simply stated, is that a lack of scientific data or knowledge should not prevent action to protect natural resources. The precautionary principle is about action to protect the environment before science has reached its conclusions; a political statement that a lack of science should not stop protective action.[143]

Where decisions are made based on a variety of inputs, principles of accountability suggest that those inputs should be explicit. The explicit consideration of non-scientific factors in decision

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137 Peel, above n 66, 336-345
138 Kennedy, above n 67, 5; Peel, above n 66, 73-74.
139 Okasha, above n 69, 121.
140 V. Walker, 'The Myth of Science as a "Neutral Arbiter" for Triggering Precautions' (2003) 26 *Boston College International & Comparative Law Review* 197, 199-215/
141 Ibid, 228.
142 Peel, above n 66, 336-345.
143 Boesch, above n 109, 194.

making is also vital for the science itself.[144] As it stands, decisions are being made based on a variety of factors, but attributed to science as the only legitimate consideration.[145] This leads to a variety of consequences. First, it tarnishes the reputation of the science, secondly it leads to decision makers trying to shape the science to meet their political or economic ends, and finally it leads to the real science being ignored as political.[146] In order to ensure that the science is independent of this type of influence, those other inputs must be allowed their own, clearly identifiable, place in decision making frameworks.

Thesis Outline – Legal Structures and the use of Science in Regional Fisheries Management Organisations

The purpose of this study is to identify, through a comparison of decision making processes within a group of RFMOs, the features of RFMO legal frameworks that are positively or negatively correlated with the effective use of science in decision making. Also, by comparing the legal frameworks of the selected RFMOs to the literature on the on the integration of science and management, features that are beneficial for inclusion within those legal frameworks will be identified.

RFMOs are defined as "intergovernmental fisheries organisations or arrangements that have the competence to establish fisheries conservation and management measures".[147] These bodies can be contrasted with the consultative or advisory fisheries organisations which are called Regional Fisheries Bodies (RFBs) and generally have no power to implement management measures. RFMOs can be further divided into those that manage either a single species or a group of closely

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[144] J. Maguire, 'Review of Factors Contributing to Overexploitation and Unsustainability in Fisheries' in C. Bodiguel, D. Greboval and J. Maguire (eds), *Factors of Unsustainability and Overexploitation in Marine Fisheries: Views from the southern Mediterranean, West Africa, Southeast Asia and the Caribbean* (The Food and Agriculture Organization, 2009), 47.

[145] Ibid, 47.

[146] Ibid, 47.

[147] The Food and Agriculture Organization, 'International Plan of Action to Prevent, Deter, and Eliminate Illegal, Unreported and Unregulated Fishing', (The Food and Agricultural Organisation, Rome, 23 June 2001), avaliable at http://www.fao.org/docrep/003/y1224e/y1224e00.htm, para 6c.

related species, such as the tuna RFMOs, and those that manage multiple species within a particular geographic area. This thesis focused on those RFMOs which manage multi-species rather than the single species as they have been less extensively documented in the literature and offer the opportunity to compare legal structures adapted to a variety of circumstances. The RFMOs to be examined are:

- Convention on the Conservation of Antarctic Marine Living Resources (CCAMLR);
- South East Atlantic Fisheries Organisation (SEAFO);
- General Fisheries Commission for the Mediterranean (GFCM);
- Northwest Atlantic Fisheries Organization (NAFO);
- North East Atlantic Fisheries Commission (NEAFC); and
- South Pacific Regional Fisheries Management Organisation (SPRFMO).

The interaction of science and decision making in RFMOs, particularly of the impact of legal structures on that interaction, has not been subject to extensive examination.[148] Additionally, "numerous commentators have pointed to the inadequacies in the way scientific information is currently applied to coastal or estuarine management decisions" leading to the conclusion that further work is needed to understand how the use of scientific information can be more effectively used in management decision making and in particular how legal structures can facilitate this.[149] Johnstone, in a 1995 article, pointed out that one of the greatest inadequacies in our understanding of fisheries management is the lack of comparative studies.[150] Whilst he was concerned with geographic and temporal diversity of study, the conclusion can be applied to the legal literature on

[148] Peel, above n 66, 64-72.
[149] T. Leschine et al, 'Challenges and Strategies for Better Use of Scientific Information in the Management of Coastal Estuaries' (2003) 26(48) *Estuaries* 1189, 1189.
[150] D. Johnston, 'Stresses and Mind-sets in Fishery Management' (1995) 18(154) *Dalhousie Law Journal* 154, 162.

RFMOs as there is a lack of comparative analysis of the legal structures used to encourage the most effective use of science in fisheries management institutions.[151]

This thesis will focus on how legal structures affect the way scientific advice and management decision making interact within RFMOs. It will aim to explore the effect of current legal arrangements and what impact they have (both negative and positive) on how science interacts with decision making. Additionally, it will discuss how legal arrangements could be modified in order to improve the way management decisions are made, including how to make more effective use of scientific advice.

As a first step, Chapter Two will analyse the literature on the interaction between fisheries science and management. It begins by charting the historical development of the disciplines followed by the literature on the current best-practice of fisheries science and management. This survey will show that the integration of scientific knowledge into management frameworks faces a number of challenges. The challenges will be identified as: the perceived bias and non-independence of scientific advice, undue influence of external factors on scientific advice, poor communication of scientific advice, a lack of responsiveness, a lack of legitimacy, a lack of relevance, and limited integration with other forms of knowledge. Following the survey of the literature the chapter will seek to describe the factors that assist to best integrate fisheries science and fisheries management. Finally the chapter will argue that legal instruments, whether they be high-level multilateral treaties, agreements creating RFMOs or the internal working procedures of an RFMO, all must be created cognisant of this integrative role and include suitable structures and processes to allow science to be effectively integrated into the management process.

Chapter Three will provide an overview of the multilateral treaties that govern international fisheries management and examine the way in which they frame the relationship between fisheries

151 Ibid, 162.

science and decision making. Several themes will become apparent within the chapter. First, that a majority of the treaties are designed to provide a balance between a right (to fish) and a responsibility (to not interfere with other people fishing). Secondly all ascribe to the objective of sustainable utilisation of fish stocks, or a closely related objective. Thirdly, cooperation is promoted as the solution to the tragedy of the commons on the high seas. The final theme is the idea that scientific evidence must be the first basis for making management decisions about fish stocks. The chapter will conclude that the multinational international legal framework for fisheries management provides a general basis for the integration of science into RFMOs but that greater detail is required if the legal framework is to assist in making that integration effective.

Chapter Four focuses on the legal arrangements that create the individual RFMOs. It will compare the differences in legal arrangements between selected RFMOs and discuss the effect that the differences might have on the interaction between science and decision making. The aim will be to understand how and how well those agreements incorporate scientific information into decision making. The chapter will identify several features of the agreements that could hinder the effective use of science. First it will note in some convention texts the objective of management based on a scientifically defined outcome. For example both NAFO (pre-2007) and NEAFC use the term optimum utilisation to define their goal. Optimal utilisation is MSY modified by economic and social factors. The use of this terminology gives scientists clear guidance as to the goal and even the methodology they should use, but also ties them to using a scientific methodology and approach that many now consider out of date. The second issue noted is the inclusion within RFMOs of best practice principles such as the ecosystem approach and the precautionary approach. The chapter will argue that it is appropriate for political agreements to determine the aim of management (such as the protection of an ecosystem as a whole), but it is quite ineffectual for political agreements to dictate that a certain approach to science be used (such as the ecosystem approach to understanding fish stocks). The incorporation of the precautionary approach to management does not raise the same problems as the ecosystem approach as it is not a scientific principle, but rather the opposite. It is a principle for managers to follow when science cannot provide an answer. The chapter will argue that the ability of some RFMOs to make decisions in the absence of consensus scientific advice (often relying on the precautionary approach) is a key characteristic of those RFMOs that effectively use scientific information (such as CCAMLR).

Chapter Five will examine the decision making record of each RFMO by comparing the recommendations of the scientific advisory body with the conservation measures adopted by the decision making body. The chapter aims to determine which RFMOs make the most effective use of their scientific advice and to understand the reasons for not following scientific advice. It will find that none of the RFMOs examined automatically turn scientific recommendations into binding conservation measures. But all of them consider science, and all have a mechanism for scientific information to be provided to decision makers. Indeed many of the commissions or councils found it extremely difficult to make decisions in the absence of scientific advice or scientific consensus. Where science was not present, decision makers could neither reach consensus themselves nor devise appropriate measures. Unfortunately in all the RFMOs examined there were decisions to implement measures contrary to scientific advice. The analysis shows that CCAMLR is the RFMO within which decision makers would most likely follow scientific advice. SEAFO, NEAFC and NAFO followed scientific advice consistently but not always, while GFCM was both the least transparent in reporting and had the least evidence of enacting conservation measures consistent with scientific advice. In summary, the analysis of public reporting found that the bare legal requirement for decisions to be based on science was not enough to ensure that RFMOs were able to implement conservation measures to be able to meet their mandated aims of sustainable use of fish stocks. The analysis also showed that in many of the RFMOs no reasons were given for a divergence between scientific advice and the decisions made. This lack of transparency in reporting was consistent across RFMOs (CCAMLR was an exception). Where a reason was provided it was normally a general statement as to the lack of consensus or a disagreement in relation to the fidelity of the science. Often, even where all information was provided within a report, the structure of the report made it difficult to compare a specific scientific recommendation to the relevant conservation measure.

Chapter Six represents the core of the thesis with a detailed analysis given on how the different legal structures underpinning RFMOs impact their use of science. The chapter will compare the literature on using science in decision making with current practices in RFMOs and argue that changes to legal frameworks could improve the way that science is used within RFMO decision making. The analysis showed that it is important (more important than the independence of the scientific advisor) that Member States (the power holders in decision making) ascribe legitimacy to the science and that the science provided is responsive to the needs of decision makers in terms of subject, format and timeliness. This is an example of where the emphasis in the general literature on the independence of science may not be consistent with the specific needs of RFMOs. From the analysis in chapter five it becomes clear that the key enabler to better use of scientific information within RFMOs is transparency. The chapter will argue that current RFMO transparency measures, (such as the presence of NGO observers), are not supported by the legal frameworks. This could be improved by rules increasing the effectiveness of observers with measures such as by ensuring their access to information. The chapter then argues that a key area for improvement is the requirement for the publication of decisions and scientific advice. The chapter will suggest that if publically available reporting included all scientific recommendations, the decisions made on them and the reasons for those decisions, in a structure that makes it easy to compare scientific recommendations and final decisions, then the use of science would be more effective (as there would be greater ability to scrutinise the decisions of Member States). Finally it is argued that transparency requirements should not be left to the discretion of the decision making body itself, but rather they should be mandated within the legal framework.

Chapter Seven of the thesis presents a case study on the impact of the legal framework on decision making within a politically charged environment - namely the decision by CCAMLR to create a

MPA in the Ross Sea. This chapter will apply the analysis from chapter six to the discussions on the MPA and show the importance of legal frameworks for the effective use of science in making challenging decisions. The chapter argues that in these situations science will not be the only, or even primary source of information for decision makers and that it is important RFMO legal frameworks include a system to give voice to economic, diplomatic and social concerns if science is to be used effectively. It will also suggest that in politically charged decision making environments it is important for RFMO legal frameworks to allow and encourage the use of pre-decision making. That is the setting of criteria for making a particular decision (such as the creating of a MPA) in general, before attempting to make a determination of a specific MPA. It is proposed that setting general criteria would encourage principal based decision making using the best available science.

Finally, Chapter Eight of the thesis will summarise the conclusions about which aspects of legal arrangements have the greatest effect on the use of science by decision makers and what changes to those legal arrangements could improve the efficiency of RFMOs. The conduct of comparison between RFMOs has allowed those features that are conducive to improved performance to be identified and, hopefully, adopted by all RFMOs. This thesis aims to use the comparison between RFMOs to identify features that could be usefully included in the legal frameworks of RFMOs to improve performance in one key area; the effective use of scientific advice. It is hoped that as RFMOs continue to develop they will pay greater attention to the relationship between scientific advisor and decision maker and perhaps by updating legal arrangements (to incorporate greater transparency measures, greater inclusion of the economic and social sciences and responsive scientific advisors) that they will be better placed to manage fish stocks in the face of future challenges.

Marine capture fisheries are a vital source of sustenance and economy for a large part of the world's population and they are a gift that does not require us to plant or grow, but only to manage. If these stocks are managed correctly they can continue to provide fish to us, and to the generations that follow us. The task of managing fish stocks on the high seas has fallen to cooperatives between States called RFMOs and these organisations rely on the insights of science to make decisions that are key to the sustainability of the stocks they manage. This thesis examines the way in which legal structures shape the way RFMOs use science and attempts to understand which features make one a more effective user of science than another. The aim of the study is to gain insight into how legal frameworks assist in making RFMOs more effective users of science and hence more effective managers of fish stocks. Facilitating decision making and the effective use of scientific information must be an important part of the duty of legal frameworks if those frameworks are going to play a part in securing the sustainability of fish stocks for generations to come.

Chapter 2

The Management of Fisheries Resources and Fisheries Science

This chapter will focus on the relationship of fisheries science and fisheries management decision making. It will begin by differentiating fisheries science and management from science and management decision making in general terms.

The first differentiating feature is the current degradation of fish stocks and marine ecosystems around the world. For example, analysis by Alder *et al*, stated that not one of the 53 States assessed met the standards of best-practice in fisheries.[152] It should be noted that not all fisheries scientists are so pessimistic, Branch argues that while some poorly managed fisheries will collapse, some, those being well managed, will not.[153]

The second point of difference is the complexity of the marine ecosystem and its components. As an example of the complexity facing fisheries scientists consider that many fish: are very flexible in their diet,[154] grow throughout their natural lives in a relatively even fashion, and their diet can change.[155] Therefore fish can have very wide ranging complex food webs.[156] The marine environment is also unlike the land environment in that it is more akin to "a single continent only partially divided by land masses".[157] This means that there is a greater level of connectivity and interaction between populations and species.[158] This and other difficulties faced by fisheries science have caused them to lament that the problem of counting fish is 'like counting trees except they are invisible and move'.[159]

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152 J. Alder et al, 'Aggregate performance in managing marine ecosystems of 53 maritime countries' (2010) 34 *Marine Policy* 468, 473.
153 T. Branch, 'Not all fisheries will be collapsed in 2048' (2008) 32 *Marine Policy* 38, 39.
154 P. Larkin, 'Fisheries Management: An essay for ecologists' (1978) 9 *Annual Review of Ecology and Systematics* 57, 60.
155 Ibid, 60.
156 Ibid, 61-63.
157 Ibid, 62.
158 Ibid, 62.
159 R. Hilborn, 'The dark side of reference points' (2002) 70(2) *Bulletin of Marine Science* 403, 403.

A further complication in understanding marine ecosystems is the effect of human interactions on the system. Importantly the human degradation of particular fish stocks not only affects that fish species but also the whole marine ecosystem.[160] This impact on the ecosystem can be increased when apex predators are targeted. Apex predators are regularly both targeted by fishers and ecologically important within the marine ecosystem. An example is the bill fish, which is extensively targeted by fishers as it is commercially valuable, but also a key component of the ecosystem.[161] When apex predator populations are reduced, there is often a disruptive trophic response through the rest of the ecosystem so that the total impact can be significantly greater than the number of fish taken.[162]

Cumulatively, these factors mean that fisheries science, fisheries management and the connections between them are unique. This remainder of this chapter will focus on describing a selection of the literature on fisheries science and management. First, the historical development of the disciplines will be examined for an insight into the nature and speed of change and development in fisheries science and management. Secondly, the dominant paradigms and the current best-practice of fisheries science and management will be outlined. Finally, this chapter will describe the literature on the interaction between fisheries science and management. The conclusion will describe a suggested framework of factors that are required in order to best integrate the two disciplines of fisheries science and fisheries management.

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160 Nichols, Seminoff and Etnoyer, above n 22, 51-53.

161 P. Lynch, J. Graves and R. Latour, 'Challenges in the Assessment and Management of Highly Migratory Bycatch Species: A Case Study of Atlantic Marlins' in W. Taylor, A. Lynch and M. Schechter (eds), *Sustainable Fisheries: Multi-Level approaches to a Global Problem* (American Fisheries Society, 2011) 197, 198-199.

162 Ibid, 193.

The History of Fisheries Science and Management

Fisheries science and management arose from our failures to use fish stocks sustainably. One of the most startling examples of which was the collapse of the Canadian Cod fishery.[163] The fishery was utilised for centuries, the first exploration occurring in the 1400's, with no apparent ill effects, and by the 1700's the catch was 50000 tons per year.[164] By 1968 the total catch was over 800000 tons per year.[165] Following the declaration by Canada of a 200 nautical mile exclusive economic zone, the catch lowered to around 170000 tons per year.[166] At this time scientists were providing advice on the appropriate level of catch using models developed to estimate the sustainable exploitation level of the Cod population.[167] Unfortunately, unbeknownst to the scientists, the model was not an accurate representation of the Cod population and consistently overestimated the stock size, leading to recommended fishing levels that were also too high.[168] As the fisheries scientists gained a better understanding of the stock and developed better models, the scientists realised that they had dramatically overestimated stock sizes, but the decision makers (in this case politicians) refused to lower the allowable catch levels, based on their desire to shield coastal communities from job losses.[169] The Cod fishery ended in disaster, the stock was not able to cope with the continued fishing pressure and eventually collapsed so completely that a moratorium on fishing was required. In the end thousands of jobs were lost and the stock has still not recovered.[170] The history of the Cod stock demonstrates the trial and error development of fisheries science and

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163 R. Q. Grafton et al, 'Marine Conservation and Fisheries Management: At the Crossroads' in R. Q. Grafton et al (eds), *Handbook of Marine Fisheries Conservation and Management* (Oxford University Press, 2010) 3, 10.
164 Ibid, 10.
165 Ibid, 10.
166 Ibid, 10.
167 Ibid, 10.
168 Ibid, 10.
169 Ibid, 10.
170 Ibid, 10.

management. It is largely this trial and error, through the work of many scientists and managers, which has led to the tools and methods in use today.

The era of modern fisheries management (dating from the Second World War) is connected, at least geographically, with the collapse of those Cod fisheries. Following the lull in fishing activity during the war there was a major expansion of effort in the post war boom, an expansion driven by both increased demand and the availability of new maritime technology.[171] The fisheries management model which developed was highly centralised and top-down, driven by a desire for economic growth and technological development - management prized expansion of fishing effort rather than limits.[172] As early as 1966 scientists began modelling population dynamics.[173] These early models focused on assessing the biomass of, and levels of recruitment into, wild populations, with the aim of determining the amount of fish that could be exploited by industry.[174] Fisheries scientists still use population dynamics and recruitment models today but the models have, since the late 1970's, had a greater focus on assisting management achieve sustainable development (which is the idea that economic development can continue without imposing an unreasonable, exploitative cost on the environment).[175]

Fisheries management and fisheries science have a co-dependent relationship. Changes in the focus of management have led to changes in science (particularly in regards to modelling), and changes in science (particularly the technology of enforcement) have led to changes in management.[176] First this relationship focused on helping to rebuild fishing fleets following World War II, then in helping the global expansion of fishermen to all regions of the world.[177] Recently

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171 Garcia, above n 57, 88.
172 Ibid, 88.
173 R. Levins, 'The strategy of model building in population biology' (1966) 54(4) *American Scientist* 421.
174 Ibid, 421-422.
175 Garcia, above n 57, 88.
176 J. Caddy, 'Fisheries management in the twenty-first century: will new paradigms apply?' (1999) 9 *Reviews in Fish Biology and Fisheries* 1, 6-9.
177 Garcia, above n 49, 174.

science and management have refocused to address the rising sustainability challenges confronting fish stocks.[178] Garcia summaries these changes as showing a long term trend of science moving from assisting the growth of fisheries to science supporting management and restoration of fisheries.[179] Concurrent with this focus on sustainability, fisheries management has become more holistic, inclusive of people and economics, rather than only considering biology and ecology. So too has fisheries science broadened, from a perspective of seeking to understand fish biology and population dynamics, to also including social, economic and policy, matters.[180]

Today, fisheries science and fisheries management depend on interconnectedness at the physical, intellectual and philosophical levels. Contemporary science has a much greater understanding of the physical interconnectedness of the world's oceans showing that each of the great oceans is connected to the others by global currents.[181] Across this vast physical environment, science and management must give increasing focus to the holistic management of fisheries, crossing disciplines and increasingly incorporating multiple factors into the management calculus. Fisheries management and science are therefore, more complicated than they have ever been. To understand the intellectual basis of the connection between fisheries science and management, the paradigms of those disciplines must be examined.

Paradigms of Fisheries Science and Management

The Nature of Paradigms

Fisheries science is, like all science disciplines, carried out in accordance with various paradigms, as is fisheries management to the extent that it too is a type of science.[182] The concept of the paradigm applies to fisheries at two levels; at the global level referring to the methodological and

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178 Ibid, 174.
179 Ibid, 174.
180 Ibid, 175-176.
181 Nichols, Seminoff and Etnoyer, above n 22, 46-47.
182 Caddy, above n 176, 3-4.

philosophical framework used by fisheries science and management, and at the local level referring to the frame of reference or methodological solution used by a fisheries scientist to solve a particular problem.[183] Caddy argues that current paradigms in fisheries science and management have a strong geographical context, as a result of science's desire to divide phenomena into smaller areas, which in turn has led to new frameworks developing with geographical specificity.[184] The geographical isolation, Caddy argues, is compounded by discipline isolation, where more and more specialised experts examine problems through narrower and narrower lenses.[185]

Modern fisheries science has converged on the paradigm of population. Modelling developed from this idea focuses on measuring the surplus production or yield of a population.[186] Originally this relied on a methodology of age-based analysis to determine the structure and hence production of a population, but as technology improved and with that the realisation that some species were not easily aged, this methodology shifted to one of modelling based on size.[187] The focus of science on a production surplus has in turn led to the idea of yield control in management as the scientific understanding of surplus lends itself to trying to manage total catch via means such as quotas on industry or individuals.[188]

The Fundamental Constant - Uncertainty

The reason that paradigms exist in science is because of the uncertainty inherent in the scientific method.[189] An idea which might be shown to be true via deduction and many observations, can be overturned by, perhaps, one contrary observation. Uncertainty is the common property of every field of science, but it is especially pertinent to fisheries science and to the relationship between

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183 Ibid, 3.
184 Ibid, 3-4.
185 Ibid, 3-4.
186 Ibid, 6.
187 Ibid, 6-8.
188 Ibid, 11-13.
189 Okasha, above n 69, 73-86.

fishery scientists and fisheries managers. Uncertainty permeates the relationship between managers and scientists as it is understood and dealt with differently by both disciplines and therefore, inevitably, is a source of discord amongst scientists and managers. These differences in understanding uncertainty lead to communication issues between the many different fisheries stakeholders, particularly given the many and varied sources of uncertainty in fisheries science.

The problem for a fisheries manager is that the existence of uncertainty makes it hard to determine with surety at what point a fish stock is underexploited, overexploited, or degraded, even in hindsight.[190] Unfortunately the problem is not only limited to managers, given the complexity of marine ecosystems, different scientists can come to different conclusions based on the same information.[191] Marine capture fisheries are characterised by diversity, with fisheries established in all climates and involving many thousands of different species.[192] Additionally fish stocks are internally diverse, they are not just made up of single fish populations, and normally each species targeted will have several different populations across its range with each population genetically different.[193]

Fish stocks and marine ecosystems are also impacted by physical change such as changes in temperature or chemical composition.[194] Physical changes can be particularly influential on the early life stages of fish; therefore any environmental changes in the present will affect the volatility of future fish stocks.[195] A fishery is a complex system of sub-systems; of physical, biological, ecological, social and economic processes that are connected to many other systems both physical

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190 Garcia, above n 49, 179-180.
191 Ibid, 180.
192 Grafton et al, above n 163, 5.
193 The Food and Agriculture Organization, 'Fisheries Management' (FAO Technical Guidelines for Responsible Fisheries, No 4, The Food and Agricultural Organisation, 2007) 9-10.
194 Brander, above n 35, 127.
195 The Food and Agriculture Organization, 'Fisheries Management' (FAO Technical Guidelines for Responsible Fisheries, No 4, The Food and Agricultural Organisation, 2007) 41-43.

(such as metrological, oceanographic) and human (such as global labour and food markets).[196] Some have argued that uncertainty within fisheries and marine ecosystems is not as great as commonly perceived and that there are methods (e.g. incorporation of broader datasets) which can remove uncertainty, it should be noted that this view is a minority opinion.[197]

Tools for Managing Scientific Uncertainty

Given the complexity of a marine ecosystem a complete representation of the system within a computer model is not currently possible.[198] The simplification required for models both increases and decreases uncertainty, it removes the likelihood of a mistake or miscalculation within the model, or a faulty understanding of the model's results, but at the same time increases the chance that the real fishery will behave differently to the model.[199] To deal with the difficulties in modelling, solutions for dealing with uncertainty are being developed. One example is risk-based assessment criteria that are being integrated into decision making.[200] Another example is the use of fuzzy logic, which is a "method to capture the imprecision associated with everyday reasoning and offer the opportunity to model environmental problems where only a linguistic (rather than a mathematical) description is available".[201]

Mathematical models which are better equipped to calculate and communicate uncertainty, including Bayesian approaches,[202] are also being developed.[203] A study by Polacheck *et al* examined

[196] S. Garcia and A. Charles, 'Fishery systems and linkages: implications for science and governance' (2008) 51 *Ocean and Coastal Management* 505, 510.
[197] R. Myers and G. Mertz, 'Reducing uncertainty in the biological basis of fisheries management by meta-analysis of data from many populations: a synthesis' (1998) 37 *Fisheries Research* 50, 51.
[198] Garcia and Charles, above n 196, 507.
[199] Ibid, 508-509.
[200] J. Ascough et al, 'Future research challenges for incorporation of uncertainty in evnironemntal and ecological decision-making' (2008) 219 *Ecological Modelling* 383, 391.
[201] Ibid, 391-392.
[202] The Bayesian approach to improbability draws on the work 18th century mathematicians to understand the logic behind drawing inferences of probability. The tools of Bayesian approaches rely on the objective assessment of previous states of probability that are then updated with new data as it arises, creating an objective measure of probability that continues to become more accurate with more data.
[203] Ascough et al, above n 200, 392.

the use of Monte Carlo[204] modelling in the management of Southern Bluefin Tuna.[205] The study found that through explicit modelling of uncertainty and the use of scientific and statistical tools for explaining that uncertainty, modelling was able to assist in decision making, even with decisions made in an environment of high uncertainty.[206]

Scientific and Management Responses to Irreducible Uncertainty

Marine fisheries systems face an insurmountable uncertainty challenge; they are systems that change in a non-periodic manner and assigning a cause to the seemingly random changes has proven difficult.[207] Science has been able to identify that physical environmental factors are a likely cause of non-periodic shifts, but exact mechanisms have rarely been determined.[208]

The seemingly irreducible uncertainty faced by fisheries is troubling because sometimes managers can only determine the appropriate level of exploitation by trial and error and overexploitation can be masked by environmental conditions until it is irreversible.[209] In the face of such uncertainty it is hard even to assess the causes of a resource crash in hindsight, let alone to predict the future of the resource.[210] It is important that fisheries management should not allow uncertainty to hinder decision making.[211] Unfortunately for fisheries decision makers, irreducible uncertainty is a "fact

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204 Monte Carlo methods are a groups of algorithms developed in the 1940's used in computer based models. The algorithms calculate answers based on repeated random sampling thus they replicate in part some of the random factors in nature, they are used extensively in modelling highly complex systems such as nuclear physics and fluid mechanics.
205 T. Polacheck et al, 'An initial evaluation of management strategies for the southern bluefin tuna fishery' (1999) 56(811-826) *ICES Journal of Marine Science*.
206 Ibid, 824-826.
207 R. Q. Grafton and J. Silva-Echenique, 'How to Manage Nature? Strategies, Predator-Prey Models, and Chaos' (1997) 12 *Marine Resource Economics* 127, 128.
208 Ibid, 127-128.
209 D. Ludwig, R. Hilborn and C. Walters, 'Uncertainty, Resource Exploitation and Conservation: Lessons from History' (1993) 260 *Science* 17, 17.
210 Ibid, 17 and 36.
211 Garcia, above n 49, 179-180.

of life" and cannot be removed by current scientific methods.[212] A study by Roe describes three broad policy management responses to uncertainty within an ecosystem:

- trial and error management, where management is based on the management that has worked in the past;
- passive adaptive management, where historical data is used to create a proposed way forward; and
- active adaptive management, where all data available at the time is used to create a suite of policy options which are chosen based upon a balance between the benefit of knowing what you are getting, and the benefit of knowing how a new system will work.[213]

Charles also describes a number of different approaches to understanding and explaining uncertainty, which include: stochastic optimisation, using stochastic optimal control theory, use of uncertainty reducing simulation methods (including Monte Carlo simulation) and behavioural modelling to predict fishermen's responses to the uncertainty.[214] Risk-analysis methods are also described as a useful tool for assessing the implications of uncertainty and the validity of various responses to it.[215] These methods collectively are called "robust management" which is, simply defined, a management system where "outcomes will not be disastrous even where the beliefs in the structure of the system turn out to be incorrect".[216]

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212 M. Mangel, 'Irreducible uncertainties, sustainable fisheries and marine reserves' (2000) 2 *Evolutionary Ecology Research* 547, 547-548.
213 E. Roe, 'Varieties of Issue Incompleteness and Coordination: An Example from Ecosystem Management' (2001) 34(2) *Policy Sciences* 111, 121.
214 A. Charles, 'Living with uncertainty in fisheries: analytical methods, management priorities and the Canadian groundfish experience' (1998) 37 *Fisheries Research* 37, 39-41.
215 Ibid, 41.
216 Ibid, 41.

Paradigms of Philosophy

Paradigms of philosophy are paradigms that guide the aims and fundamental approach of fisheries science and management. Two philosophical paradigms have been developed in recent times: ecosystem management and the precautionary approach.

The Ecosystem Approach to Fisheries

The ecosystem approach was developed from the 1960's, primarily in the US through the struggle over the management of forests.[217] An ecosystem can be defined as a "functional unit comprising all the organisms in a particular place interacting with one another and their environment, interconnected by the ongoing flow of energy and a cycling of materials".[218] The ecosystem approach has been defined in international instruments, for example the *Convention on Biological Diversity* ('*CBD*') which states that the ecosystem approach is a "strategy for the integrated management of land, water and living resources that promotes conservation and sustainable use in an equitable way".[219] The goal of the ecosystem approach has been described as striving to balance diverse societal objectives, by taking account of the knowledge and uncertainties of biotic, abiotic and human components of ecosystems and their interactions and applying an integrated approach to fisheries within ecologically meaningful boundaries.[220] Ecosystem management is a difficult concept to define in relation to fisheries management, it is clear that it is not management of a single species, nor is it an approach where multiple species are managed individually; it is possibly (though imperfectly) described as an approach defined by emphasising the production of the ecosystem as a whole rather than production of its individual components.[221] Vogt identified

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217 K. Vogt et al, *Ecosystems: Balancing Science with Management* (Springer-Veriag, 1996), ch 2.
218 Nichols, Seminoff and Etnoyer, above n 22, 49.
219 *Convention on Biological Diversity,* opened for signature 5 June 1992, 1760 UNTS 79 (entered into force 29 December 1993) ('*CBD*').
220 C. De Young, A. Charles and A. Hjort, 'Human dimensions of the ecosystem approach to fisheries: an overview of context, concepts, tools and methods' (2008) 172.
221 Vogt et al, above n 217, 97.

a range of principles connected to ecosystem management, including that ecosystem management is:

> the necessary melding of natural science tools and data, and bureaucratic and social science techniques. A balance must be struck between the physical and biological facts of ecosystems and the equally real human factors.[222]

Of course no definition of ecosystem management is universally accepted but fortunately an exact accepted definition is not required for the approach to be valuable to fisheries managers.[223]

Fundamentally the ecosystem approach to management is about the management of natural systems, such as a marine ecosystem, along with associated systems, such as the social system of the coastal community.[224] The link to the social system is vital as there is no natural system that is not currently, or has not previously, been affected by human interaction.[225] The system to be managed is therefore made up of a multitude of parts, and the reality is that not all parts of an interconnected system can produce a maximum yield at the same time.[226] This fundamental constant of finite systems can often be overlooked when multiple single species are managed independently for a maximum yield.[227]

Management of an ecosystem requires management of both the structure (biological and non-biological) and the functions of the ecosystem.[228] It also requires the ability to recognise the properties of different ecosystem states and to detect the changes between states.[229] Factors such as species diversity, primary production, changes in trophic levels and changes in nutrient levels are just some indicators of an ecosystem state.[230] Because there is such diversity in ecosystems and

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222 Ibid, 101.
223 De Young, Charles and Hjort, above n 200, 129-130.
224 Vogt et al, above n 217.
225 Ibid, 105-114.
226 Ibid, 105-114.
227 Ibid, 96-102.
228 Ibid, 96-102 and 190.
229 Ibid, 190-196.
230 Ibid, 190-196.

in the human use of them there is likely no single set of scientific or management tools that will work for all ecosystems. Rather each ecosystem will require its own tools created by managers informed by previous knowledge of different types of ecosystems, adding to the scientific advice required for effective ecosystem management.[231]

The ecosystem approach to fisheries management is now the prevalent paradigm in academic thought, however the use of single species models is still the dominant technical method used in practice by fisheries managers.[232] In practice the idea of the ecosystem approach to fisheries has been partially implemented by seeking to reduce the effect of fisheries on bycatch species, by improving the gear selectivity for species and age, by utilising habitat protection tools and by incorporating aspects of the ecosystem into the long-term scientific advice they receive.[233]

The Precautionary Approach to Fisheries

The precautionary approach was first stated in international law in the text of *the Rio Declaration*:

> In order to protect the environment, the precautionary approach shall be widely applied by States according to their capabilities. Where there are threats of serious or irreversible damage, lack of full scientific certainty shall be not used as a reason for postponing cost-effective measure to prevent environmental degradation.[234]

The precautionary approach should now be applied to fisheries through Article 6(5) of the soft law, FAO International Code of Conduct for Responsible Fisheries ('*the FAO Code of Conduct*').[235] The FAO has also developed implementation guidelines for the precautionary approach to support

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[231] Ibid 367-387.
[232] Plaganyi, E., 'Models for an ecosystem approach to fisheries', (FAO Fisheries Technical Paper No 477, The Food and Agriculture Organization 2007).
[233] De Young, Charles and Hjort, above n 220.
[234]Rio Declaration on Environment and Development adopted on 13 June 1992 UN Doc. A/CONF.151/26 (vol. I); 31 ILM 874 (1992) ('*The Rio Declaration*'), principle 15.
[235] The FAO International Code of Conduct for Responsible Fisheries adopted 31 October 1995, FAO Doc. 95/20/Rev/1 ('*The FAO Code of Conduct*'), Art 6(5).

its implementation.[236] These guidelines state that the approach "involves the application of prudent foresight, [t]aking into account the uncertainties of fisheries systems."[237] The guidelines go on to state that the approach requires *inter alia*:

- consideration of the needs of future generations and avoidance of changes that are potentially irreversible;
- prior identification of undesirable outcomes and of measures that will avoid them, or correct them promptly;
- the initiation of necessary corrective measures without delay, and that any measures should achieve their outcome on a timescale not exceeding two to three decades;
- that where the likely impact of resource use is uncertain, priority should be given to conserving the productive capacity of that resource;
- that all fishing activities have prior authorization and are subject to periodic review;
- that legal and institutional frameworks incorporate the guidelines for precautionary management;
- that there is appropriate placement of the burden of proof; and,
- that the standard of proof used in decisions regarding authorization of fisheries be commensurate with the potential risk to the resource, whilst also taking into account the expected benefits of the activities.[238]

It is clear that the precautionary approach requires the explicit consideration of undesirable and potentially unacceptable outcomes prior to decisions on a course of action being made.[239] For

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[236] The Food and Agriculture Organization, 'Precautionary Approach to Capture Fisheries and Species Introductions', (FAO Technical Guidelines for Responsibile Fisheries, No 2, The Food and Agricultural Organisation, 13 June 1995), 8-16.
[237] Ibid, 6.
[238] Ibid, 6.
[239] Ibid, 6-8.

fisheries scientists this means that they must be able to inform decision makers of the probable outcomes of different proposed courses of action.[240]

Paradigms of Technique

There are many different approaches to fisheries management. Quantitative ecologists argue that controlling uncertainty will be the solution to management of fisheries; economists have long argued that the creation of private property rights will provide a solution, while many sociologists have argued that communities connected to the fishery are best placed to manage fisheries.[241] Both fisheries scientists and managers operate in an environment where different sets of tools and systems are available to be used. Often these tools or systems are developed in response to, or derived from the dominant philosophical paradigm, for example, the ecosystem approach may lead to the development of scientific models that a single species approach does not.

The techniques currently used are highly rational and based on a positivist view of science. They assume that we can understand the fishery enough to design measures to protect it and on the fact we can design measures that will control fishermen. Hence the modern era of fisheries science and management is characterised by the development and use of indicators and reference points as tools for science and management.[242] Although the ecosystem approach is described about as being the prevalent paradigm, it is single species science that still underpins most scientific advice to RFMOs, partly due to the additional cost associated with utilisation of ecosystem models.[243] Nevertheless techniques are continuing to develop that will adapt to the more recent ecosystem approach to fisheries, with scientists striving to develop indicators for biodiversity, bycatch, habitat

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240 Ibid, 9-10.
241 Pitcher, above n 10, 602.
242 The Food and Agriculture Organization, 'Indicators to Assess the Performance of Regional Fisheries Bodies', (Second Meeting of FAO and Non-FAO Regional Fisheries Bodies or Arrangments, The Food and Agricultural Organisation, RFB/II/2001/3, 20-21 February 2001), 1-6.
243 Plaganyi, E., 'Models for an ecosystem approach to fisheries', (FAO Fisheries Technical Paper No 477, The Food and Agriculture Organization 2007) 232, 1.

state and many other ecosystem factors.[244] Once scientists develop these indicators managers will be able to develop reference points for the specific fisheries or ecosystem that they manage.

Maximum Sustainable Yield

Maximum Sustainable Yield (MSY) has been the dominant reference point for much of the post-war period of fisheries management.[245] This indicator is enshrined in law as the goal for much of fisheries management even though science has moved away from the concept.[246] This scientific retreat from MSY is based on the fact that it fails to recognise the fundamental importance of the ecosystem in managing fisheries with many scientist now more comfortable refereeing to the 'maintenance of a sustainable ecosystem state'.[247]

MSY arises from the work of fisheries scientists who found that there was theoretically a population level (often less than the naturally occurring unexploited level) at which the recruitment to the stock was maximal, they believed that by reducing the stock to this level and then fishing an amount equivalent to the annual recruitment that it was possible to take this maximal recruitment in perpetuity.[248] MSY was not just a biological tool, but an economic one, with the measurement showing that fishers should put in enough effort to catch a certain number of fish, but no more (as it would deplete the stock and lower future yields) or no less (as the population would rise and recruitment to the stock would no longer be maximal).[249] It allowed an argument that in the case of many unexploited stocks there should be a fishing down of the population to such a point that

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244 The Food and Agriculture Organization, 'Indicators to Assess the Performance of Regional Fisheries Bodies', (Second Meeting of FAO and Non-FAO Regional Fisheries Bodies or Arrangments, The Food and Agricultural Organisation, RFB/II/2001/3, 20-21 February 2001) 3-6.
245 Vogt et al, above n 217, 1.
246 Ibid, 1.
247 Pitcher, above n 10, 606-608.
248 G. Lugten and N. Andrew, 'Maximum Sustainable Yield in Marine Capture Fisheries in developing Archipelagic States - Balancing Law, Science, Politics and Practice' (2008) 23(1) *International Journal of Marine and Coastal Law* 1, 3-4.
249 P. Larkin, 'An Epitaph for the Concept of Maximum Sustained Yield' (1977) 106(1) *Transactions of the American Fisheries Society* 1, 6-8.

competition within the stock decreased and yield therefore increased.[250] The concept of MSY has been widely used and accepted since the 1950's, but as early as 1977, when Larkin published "An Epitaph for the Concept of Maximum Sustained Yield", the concept has been questioned.[251] In his paper Larkin highlighted a range of concerns with the use of MSY, arguing: that it did not reflect the age structure of species, that it did not account for the loss of spawning biomass and that it had a high risk of over-estimating production of a real fish population.[252] Additionally, Larkin highlighted that MSY was not necessarily the best economic solution and that lower levels of yield could produce a better outcome if market dynamics were considered.[253] He concluded that the time of MSY was over as it could not deal with the complexities of managing even a single species, let alone ecosystems where multiple resources are exploited.[254] Interestingly, MSY lives on and is embedded in most international fisheries agreements.[255] Following Larkin's work others have stated that in multi-species fisheries MSY as a target cannot be complied with, as the harvest of MSY of one species, may lead to the over-catch of another species.[256] Despite these documented shortfalls, MSY continues to be used in an adapted and flexible way. For example; while its use as a goal is problematic, its use as an upper limit of exploitation reference point has been more easily accepted by fisheries scientists.[257] Therefore the continuation of MSY's use is due in part to its evolution into forms which allow it to assimilate into newer paradigms of fisheries management.

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[250] Ibid, 1-6.
[251] Ibid, 1-6.
[252] Ibid, 1-6.
[253] Ibid, 9.
[254] Ibid, 9.
[255] Ibid, 10.
[256] Lynch, Graves and Latour, above n 161, 197.
[257] P. Mace, 'A new role for MSY in single-species and ecosystem approaches to fisheries stock assessment and management' (2001) 2 *Fish and Fisheries* 2, 19-25.

Paradigms for the Future

The cornerstone of Kuhn's work on scientific paradigms was the idea of change through revolution, that there is the constant prospect of a dramatic shift.[258] It is likely that fisheries science follows this path and that the fisheries science of the future will be different to the fisheries science of today.

Caddy describes a theory of the evolution of fisheries science and management paradigms in order to predict the future of those disciplines.[259] He describes how paradigms in fisheries science have evolved in localised geographic areas.[260] He asserts that within each geographic area the new ideas start as an additional explanatory mechanism for the old paradigm, but they are then used for a wider and wider range of explanations, until, if they are sufficiently powerful, they replace the old paradigm in that region.[261] In Caddy's theory, paradigms of fisheries science have a dramatic effect on fisheries management and vice versa.[262] For example if single species stock assessments are used by fisheries scientists for a particular stock, it leads to the use of individual catch quotas, but, if the scientists use fishery wide assessments it leads to the greater use of gear and spatial restrictions.[263] In this context future changes in fisheries science may come from changes in the technology or management tools.[264] For example telemetry and remote sensing will allow greater control of individual fishing vessels, allowing managers an increased use of temporal and area closures, in turn requiring the focus of fisheries science to change from recruitment studies to understanding the geographic dispersal of a stock.[265]

258 Kuhn, above n 73, ch 8.
259 Caddy, above n 176.
260 Ibid, 5-6.
261 Ibid, 11.
262 Ibid, 11-12.
263 Ibid, 11-12.
264 Ibid, 34-36.
265 Ibid, 34-36.

Other theorists agree that the current management methods have failed and that new methods are needed to better solve the problem.[266] However, unlike Caddy, these scholars view this failure as caused by a failure to integrate science into a holistic approach that focuses on community management and an understanding of the whole fisheries system rather than by a lack of scientific understanding.[267] This desire for community management has created the concept of 'sustainable livelihood management'. This concept is based on an anthropocentric analysis of fisheries, expanding the ecosystem considerations to include not just the fishery but the whole of the fishers' life.[268] The management framework that arises from these ideas is one that looks not only at protecting the fish stock but rather at changing the livelihood system of the fishermen. To date this approach has only proven useful when targeted at small scale, low income fishers, who do not operate on the high seas, but like all paradigms, if it is effective it may operate more broadly in time.[269] Any paradigm will only survive if it can adequately deal with the challenges facing fisheries. These challenges are becoming more and more acute, with fisheries under increasing pressure on many fronts, making it difficult for any one idea or system to solve all the problems facing fisheries.

Science as the Primary Advisor to Fisheries Management

Fisheries governance contains a number of different elements and parts, it has been defined as:

> the exercise of economic, political and administrative authority. It encompasses: (i) the guiding principle and goals of the sector, both conceptual and operational; (ii) the ways and means of the organisation and coordination of action; (iii) the infrastructure of socio-political, economic and legal institutions and instruments; (iv) the nature and modus operandi of the process; (v) the actors and their roles; and (v) the policies, plans and measures.[270]

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266 A. Bundy et al, 'If science is not the answer, what is? An alternative governance model for the world's fisheries' (2008) 6(3) *Ecological Environment* 152, 152.
267 Ibid, 153-154.
268 E. Allison and B. Horemans, 'Putting the principles of the Sustainable Livelihoods Approach into fisheries development policy and practice' (2006) 30 *Marine Policy* 757, 758.
269 Ibid 268, 761.
270 Garcia, above n 57, 90.

There are diverse views about what constitutes effective management. One approach to effective fisheries management, put forward by Grafton *et al,* is called the benchmarking approach.[271] This approach is designed to incorporate the ecosystem approach and community management into practical fisheries management.[272] It is based on three assumptions; first that the objective of fisheries management must be sustainable fish stocks, secondly that managers must explicitly account for uncertainty, and thirdly that sustainable and profitable fisheries are mutually reinforcing.[273] Within this approach a fishery management system can be benchmarked against five criteria to evaluate effectiveness. The criteria are; accountability, authority and responsibility, transparency, incentives, risk assessment and management, and adaptability.[274] The proponents of this approach argue that when all those factors are properly in place within a management system, it will be effective.[275]

In agreement with the benchmarking approach Mora *et al* suggests that fisheries management requires "a (1) robust scientific basis for management recommendations, (2) transparency in turning recommendations into policy, (3) capacity to enforce and ensure compliance with regulations, and minimizing the extent of (4) subsidies, (5) fishing overcapacity, and (6) foreign fishing in the form of fisheries agreements".[276] Importantly Mora *et al* argue that science is critical to fisheries management, but that it must be scientific advice in which uncertainty is minimised by the use of skilled personnel, models which include the ecosystem, and the use of high quality relevant data.[277] The approach to effective management by both Mora *et al* and Grafton *et al*

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[271] R. Q. Grafton et al, 'Benchmarking for fisheries governance' (2007) 31 *Marine Policy* 470.
[272] Ibid, 474-478.
[273] Ibid, 473.
[274] Ibid, 474-475.
[275] Ibid, 475 and 478.
[276] C. Mora et al, 'Management Effectiveness of the World's Marine Fisheries' (2009) 7(6) *PLoS Biology*, 1-2.
[277] Ibid, 1-4.

emphasise issues surrounding science when discussing fisheries management and both are clear when singling out science as the cornerstone for effective fisheries management.

Fisheries science has for many years been the most important source of advice to fisheries decision makers, the two fields have co-evolved, each one influencing and being influenced by the other.[278] Lane and Stephenson argue that the historic dominance of science in fisheries management has had a defining influence on the current institutional structures.[279] In their article (referring to fisheries management organisations in Canada) they state that "the historical importance of scientific advice has meant that other branches [of advice] have evolved as reactive and subordinate to that primary advice".[280] They also state that when financial and political pressures bear on science-based organisations such as fisheries management organisations they are prone to close ranks to protect themselves. This, they argue, leads to a "republic of science", where decisions are made without integration with other streams of knowledge.[281]

Mora *et al* reports that national authorities state that they largely (92%) consider scientific advice when deciding on catch limits and that in 87% of cases stakeholders are also consulted.[282] However, the research goes on to state that in 91% of cases there is political and economic pressure to increase catch limits to levels that are not precautionary, they conclude that the process of fisheries policy making is subject to political pressure and perhaps corruption.[283] The work by Mora *et al* was based on a survey of "fisheries experts" and while experts may hold much knowledge about fisheries issues it is not likely that they present a complete picture of fisheries.[284] Garcia, concluded that both scientists and managers need to understand that fisheries science, while a powerful tool,

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278 Garcia, above n 57, 93.
279 D. Lane and R. Stephenson, 'Fisheries Co-management: Organization, Process, and Decision Support' (1998) 23 *Northwest Atlantic Fisheries Science* 251, 253-256.
280 Ibid, 253-254.
281 Ibid, 254.
282 Mora et al, above n 276, 3.
283 Ibid, 3.
284 Ibid, 1-2.

cannot provide certainty as to management outcomes and that it is only a source of advice not the only source of advice.[285]

The Current Effectiveness of Science as the Primary Advisor to Management

The final decision in regards to the management of fisheries is not, (at least in RFMOs) made by the scientific body, but rather by a political decision making body. In many RFMO's the conservation measures adopted by the political body do not always match the advice provided by the scientific body.[286] Science clearly is not the only consideration for fisheries decision makers but it is vital that their decision is at least based on a valid ecological understanding of sustainability.[287] If science is not always being adhered to, the obvious question is to ask 'Why'? As an answer to this puzzle, Garcia poignantly states that "it is clear that fisheries science is suffering, in its development and evolution as well as in its reputation, from its close relation to decision making."[288] Interestingly, Garcia further suggests that it is precisely because science is the primary advisor to fisheries managers, that it has less influence with them.

The failure of RFMO decision making bodies to implement decisions that reflect the advice of the scientific body has been linked in many cases to a lack of political will on the part of the Member States to follow the objectives agreed to in the RFMO treaty.[289] This may be a situation where political imperatives are being considered more important than ecological advice.[290] It is clear that the interests of States have a profound influence on the outcome of the decision making process within RFMOs; they influence, shape and constrain national positions within the decision making process.[291] The factors that influence the interests of States are wide ranging, including: economic,

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[285] Garcia, above n 49, 178-185.
[286] Parris, Wright and Cartwright, above n 63, 446-449.
[287] Schechter and Blue, above n 29, 238-239.
[288] Garcia, above n 49, 191.
[289] Parris, Wright and Cartwright, above n 63, 448-451.
[290] Ibid, 448-451.
[291] Ibid, 448-451.

regional, diplomatic, employment and social concerns.[292] Despite the clear influence of these factors on the decision makers these issues are not normally openly discussed as part of the decision making process.[293]

An additional constraint in reaching agreement on more stringent conservation and enforcement measures is the concern of some States about their ability to implement those provisions.[294] Many States lack the capacity to support and enforce conservation measures properly, they have neither the scientific nor enforcement capabilities available to them, therefore they are reluctant to support measures requiring resource intensive enforcement, or measures based on information they cannot verify.[295] The solution to these issues is to address the capability gap between States, to provide assistance to less economically resourced States to ensure they have the appropriate staff to help them understand the science and to ensure that governments have the means to enforce conservation measures.[296] An alternative is to change the way the scientific information is conveyed to delegations, to enable those States without specialist scientific advisors to understand the information themselves.[297] Providing non-scientists with clarity in regards to the nature of proposed fisheries conservation measures, and the scientific basis for them, will increase the decision makers' ability to properly make decisions.[298]

Scientific Effectiveness in the IATTC[299]

Oh in her thesis analyses on the effectiveness of scientific advice at the Inter-American Tropical Tuna Commission (IATTC) notes that the secretariat is science-focused and has an independent

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[292] Ibid, 448-451.
[293] Ibid, 448-451.
[294] Lugten and Andrew, above n 248, 3 and 31.
[295] Parris, Wright and Cartwright, above n 63, 451-452.
[296] Ibid, 451-452.
[297] Ibid, 451-452.
[298] Ibid, 451-452.
[299] S. Oh, 'Role of Science in the Management of Tunas by the Inter-American Tropical Tuna Commission: Limitations to Sustainability' in W. Taylor, A. Lynch and M. Schechter (eds), *Sustainable Fisheries: Multi-Level Approaches to a Global Problem* (American Fisheries Society, 2011) 333.

staff of over sixty (60) that assist in creating and distributing scientific information.[300] Through interviews with individuals involved in the IATTC she identified that most decision makers believed that conservation measures considered by IATTC were vital to the sustainability and survival of both the commission and of the fishery itself.[301] Despite this focus and despite the IATTC overarching agreement calling for "science based management" Oh found that much of the scientific advice on conservation measures was not followed.[302] Oh's work set out to find what was causing the gap between science and management decision making.

Throughout the interviews many participants thought that the lack of adherence was primarily due to the requirement for consensus decision making, meaning that all parties had the potential to veto measures for political reasons.[303] In terms of the interaction of science and management, Oh found that nearly all participants thought the science produced by the commission was of a very high standard and useful to the decision making process.[304] However this assessment was caveated with the view that some of the scientific advice was either too technical or that the uncertainty was too high and not properly communicated to decision makers.[305] Despite the physical independence of the Commission's scientific advisors, Oh found that several interviewees were concerned about the independence and transparency of the scientific advice, showing that even in a highly independent system, issues of trust and legitimacy remain.[306] Interestingly, Oh found that while three-quarters of decision makers interviewed thought that scientific advice was important to the adoption of conservation measures, one-quarter thought that science was not important or less important than other issues.[307] Clearly this indicates that decision makers consider factors other than science when coming to decisions. Equally, Oh's interviews highlighted that economic and

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300 Ibid, 339.
301 Ibid, 346-357.
302 Ibid, 355 and 362.
303 Ibid, 349-350.
304 Ibid, 350-353.
305 Ibid, 350-353.
306 Ibid, 352-353.
307 Ibid, 354-356.

political factors were generally important to decision makers.[308] One interviewee said that "where the economic or political pain is slight the science was important but where the pain was great, it was not important at all".[309] Based on this assessment it is easy to see that a RFMO would find it difficult to adopt conservation measures that would cause short-term economic and political pain, even where the science is clear.[310]

Oh concluded that the role of science was 'to inform the decision makers with the best possible information on which to base their decision'.[311] The key roles for science in this regard were identified as, problem perception, explanation of causes, and projection of consequences.[312] However this role was tainted at the IATTC. Oh identified that political influence was part of the scientific process. Politics shaped the questions and determined how the science was conducted, and in some cases how that science was perceived. Many States at IATTC used uncertainty as a reason to disregard politically unpalatable scientific conclusions.[313] One of the ways suggested by Oh to improve this process was the use of management strategy evaluations, instead of science merely providing input to decision makers; scientists would additionally evaluate and advise on the consequences and risks of potential management options. This would make the scientific advice more immediately relevant to the decisions at hand.[314] A benefit of this strategy is that it would ensure that scientific advisors are not making political judgments on an optimal outcome but rather simply informing decision makers on the consequences of various proposals.[315] Oh's work shows that where the effectiveness of science is questioned, scientists and decision makers can implement solutions that will improve that effectiveness.

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308 Ibid, 354-355.
309 Ibid, 355.
310 Ibid, 355.
311 Ibid, 356.
312 Ibid, 356-358.
313 Ibid, 355 and 358.
314 Ibid, 358.
315 Ibid, 358.

Improving the Integration of Fisheries Science into Management

Leschine *et al* in an article focusing on estuary management found that there are a myriad of influences that can shape and change the institutions of management and can lead to better use of science.[316] Science must be responsive, relevant, salient and legitimate, in order to be valuable to management. To be salient, relevant and legitimate, it must be properly integrated into management.[317] Legal and institutional structures are vital enablers of this integration. For this reason failures in fisheries can regularly be blamed on flaws in the institutions of fisheries management.[318]

Transparency

One aspect of improving legitimacy is improving the transparency of the scientific processes. Transparency is also important because transparent decisions have been shown to be better made, than non-transparent ones.[319] In relation to transparency, best-practice is: to have an independent scientific body with appropriate technical expertise, to ensure reports and findings are subject to periodic independent review and be publically available, and that where the scientific advice is not followed reasons are given.[320] Another transparency measure that some RFMOs have adopted is the use of observers.[321] As science has become more and more involved in multidisciplinary issues, it is important to improve the communication of science and for science to allow the more active participation of stakeholders.

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316 Leschine et al, above n 149, 1202-1303.
317 Garcia, above n 49, 186-189.
318 Ibid, 175.
319 Lodge et al, above n 9, 84-85.
320 Ibid, 126-127.
321 J. Swan, 'Decision-Making in Regional Fishery Bodies or Arrangements: The Evolving Role of RFB's and International Agreement on Decision-Making Processes' (The Food and Agriculture Organization, 2004), 10.

Independence

Another important part of legitimacy than can improve the effectiveness of science is independence (which also improves transparency). There is a spectrum of different options available for achieving independence within RFMOs. At one end of the spectrum there is the option of full scientific capacity within the RFMO which is the most expensive but most independent option. Alternatively an RFMO may rely on national scientists, which may be the least expensive option but is also the least independent.[322] The Chatham House report suggests groups of RFMOs may be able to have combined scientific staff, which is one staff for all tuna RFMOs to mitigate the expense for a fully independent scientific staff.[323] Whichever solution, it is clear that the independence of scientific advice is one of the key factors in whether or not scientific advice will be able to build consensus in the decision making body.[324]

Science must be Science

Science has become indispensable to modern life because of the scientific method's unique way of examining the world. However, science must conform to the fundamental requirements of the scientific method if it is to be of value.

Rice convincingly argues that advocacy in fishery science must be resisted at all costs. In his article he highlights that there are many advocates in the world but only science has a privileged neutral position that can ensure that policy debates are based on realistic facts.[325] Rice argues that science will be strengthened not by becoming more advocacy-based, but by making the scientific process itself more inclusive (both within the natural and social science disciplines) and by presenting science in a format that is designed to assist decision makers (for example utilising risk analysis

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322 Lodge et al, above n 9, 32-33.
323 Ibid, 32-33.
324 Oh, above n 299, 352-353.
325 J. Rice, 'Food For Thought: Advocacy science and fisheries decision-making' (2011) 68(10) *ICES Journal of Marine Science* 2007, 2007-2009.

frameworks).[326] In the highly supportable view of Rice, if these steps are taken, science can be more influential on decision making without the risk of losing its privileged spot as an impartial advisor.[327]

Delimitation of Responsibility According to Strengths

Science is not best placed to undertake political consensus decision making about goals or objectives just as politics is not best placed to impartially and objectively examine ecological facts. Given these different strengths, key to improving the interaction between the science and management is clarity about what each discipline can do best. It is when these roles are not clearly delineated that fisheries scientists tend to include recommendations based on their view of the best outcome along with more objective assessments.[328] While this approach can be useful where guidance is not in place, it is not normally the role of a scientist to make recommendations on what is best, but rather merely to provide information of what the consequences of a given decision will be.[329] Unfortunately where the objectives provided are too vague it leads scientists to decide for themselves what the objective should be.[330]A problem with making such recommendations is that the scientist can stray easily into the realm of advocacy, of arguing for one policy position over another, which is antithetical to objective science.[331] There are scientists that have become advocates, moving from dispassionate advice, to passionate debaters. While this may coalesce with the personal integrity of the individuals involved, it can devalue the position of science, moving it from its objective perch, to just another objective form of policy advice.[332]

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[326] Ibid, 2010.
[327] Ibid, 2010-2011.
[328] Garcia, above n 49, 177-178.
[329] Ibid, 173.
[330] Ibid, 183-184.
[331] Ibid, 176.
[332] Ibid, 176-177.

Best-Practice Fisheries Science and Management

Fisheries science and management are evolving disciplines that are also geographically diverse, leading to many 'best-practices' around the globe. In 2007 Chatham House completed an extensive project to identify the best-practice for regional fisheries throughout the globe.[333] The Chatham House study focused on RFMOs rather than States because of the vital role of RFMOs in managing international fisheries and the assessment that strengthening RFMOs was a vital part of limiting the impact of Illegal, Unreported and Unregulated (IUU) fishing.[334]

The Importance of Objectives and Strategy

Objectives are of fundamental importance to regional fisheries management because although managers and scientists are often very good at meeting a goal, they need to first know what that goal is. The Chatham House report was clear on this, stating that RFMOs need to have "explicit overarching objectives that address the full range of outcomes and management approaches".[335] Overarching objectives are not something which scientists or managers should determine, rather they should be what the stakeholders in fisheries; communities, societies and States decide. Political rather than expert decision makers are best placed to determine agreed objectives for a fishery that has no clear owners. Scientists can, however, operationalise these objectives into goals which can be quantified and measured. To this end Chatham House sets out that RFMOs need to set target and limit reference points for all commercially targeted species.[336]

Unfortunately, short-term political expediency can mean that decisions are not taken in accordance with those pre-defined goals. In order to guard long-term politically agreed goals from short-term political interest, Chatham House recommends putting in place pre-defined strategies for dealing

333 Lodge et al, above n 9.
334 Ibid, vii and 1.
335 Ibid, 22.
336 Ibid, 22.

with particular events, such as a drop in the total sustainable catch.[337] The report argues convincingly that where there are pre-agreed plans of action; the pre-commitment makes it more likely that States will accept negative short term consequences, such as a lower national quota.[338]

Decision Making Mechanisms

For many years now there has been an abundance of criticism of RFMOs focused on their lack of ability to make timely decisions.[339] The Chatham House report argues that consensus decisions-making (where all States parties have to agree, or at least not disagree), is not best-practice, at least not without some mechanism for moving past deadlock.[340] States, however, are sovereign entities and therefore it is not possible to easily enforce their compliance with a supra-national decision, making each States' agreement vital. The solution proposed by Chatham House is that RFMOs adopt majority decision making, with any dissenting States losing access to the resource.[341] Legally they base this suggestion on the *UNFSA*, arguing that in accordance with that document states must abide by the determinations of RFMOs. Unfortunately, this assessment overlooks both the contrary interpretations of the *UNFSA* and the plain fact that there is not yet either universal ratification of the *UNFSA* or acknowledgment of customary law in similar terms. Given the strong views of many States on the absolute importance of the freedom of the seas, including the freedom to fish, attempts to exclude States that did not agree with a RFMO conservation measure would be met with resistance.

FAO has also been active in furthering the discourse on best-practice fisheries management and their work provides some insight into best-practice integration of science and management through legal mechanisms. While there are demonstrated difficulties of decision making bodies in

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337 Ibid, 26.
338 Ibid, 36-43.
339 S. Cullis-Suzuki and D. Pauly, 'Failing the high seas: A global evaluation of regional fisheries management organisations' (2010) 34(5) *Marine Policy* 1036, 1036.
340 Lodge et al, above n 9, 75-76.
341 Ibid, 74-76.

coming to consensus, there is the potential for scientific advice to play a constructive role in consensus building. In support of this, FAO has identified that best-practice fisheries science should be: right, relevant, responsive and respected.[342] FAO identifies that the credibility of the fisheries science is vital to how effectively science can influence and build consensus among decision makers.[343] According to FAO the credibility that fisheries science requires will rely on it being transparent and independent, responsive and subject to a process of internal and external peer review.[344]

Best-Practice Regional Fisheries Science–the Ward, Tsirbas and Kearney Study

Ward, Tsirbas and Kearney examined the structure for the provision of scientific advice in a range of RFMOs[345] and assessed a range of factors including; independence, priority-setting arrangements, review arrangements, industry and NGO participation, funding and training and development.[346] They found that for the selected RFMOs there were two main approaches in providing science to decision makers, the first was secretariat based science, where the permanent staff of the RFMO conducted and drafted the provision of scientific advice based on their own research and procedures.[347] The second approach was multilateral science where each Member State provided scientific information and advice to the representatives of States parties at the

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342 "Right: advice should be based on the best information available and most appropriate analysis with uncertainty articulated; and provides reasonable predictive power.
Relevant: advice should be applicable in a practical way so that it can be implemented in the political context for which it was sought.
Responsive: advice should respond to clients' needs in a flexible and timely manner, but should be forward looking and proactive to future needs.
Respected: advice should have credibility with policy and decision-makers."; The Food and Agriculture Organization, 'Indicators to Assess the Performance of Regional Fisheries Bodies', (Second Meeting of FAO and Non-FAO Regional Fisheries Bodies or Arrangments, The Food and Agricultural Organisation, RFB/II/2001/3, 20-21 February 2001) para 34.
343 Ibid, para 34.
344 Ibid, para 35.
345 RFMOs considered in the study were: IPHC, IATTC, CCSBT, ICCAT and CCAMLR. In addition the study considered the work of the FFA.
346 P. Ward, N. Tsirbas and B. Kearney, *Getting Science into Regional Fishery Management: A Global View* (Bureau of Rural Sciences, 1998).
347 Ibid, 1-4.

RFMO with the permanent secretariat providing only a coordination function.[348] They concluded that the secretariat approach to science provision provided the best quality control and was also best at ensuring the provision of holistic (in the sense of both species and geographic range) advice.[349] Conversely, they found that multilateral approaches were much more democratic and transparent in nature and therefore created scientific advice that was likely to be accepted by the States parties (who had helped create it).[350] The science produced in the multilateral approach was generally more salient, in that it was responsive to their needs.[351] As would be expected the study found that the secretariat approach to science was less prone (though not immune) from political interference with scientific independence.[352] This is in part common-sense, as in the multilateral approach the science is prepared by Member States, so political and policy considerations could be imported into their final product. Additionally, the scientists providing the advice are often paid by the State, so there is some opportunity for influence from the State's political, diplomatic or economic objectives.

Integration of Other Knowledge into Fisheries Management

In terms of expertise, fisheries have long been dominated by the ecological and biological sciences with recent inroads being made by the physical sciences, but fields of knowledge such as economics and social science are rarely included.[353] While science has a unique and useful way of looking at the world it is important to understand that it is not the only useful or unique way of examining natural or human phenomenon. Science, in particular the ecological and biological sciences, can only be a part of the holistic solution. The addition of different forms of knowledge (an interdisciplinary approach) increases the ability of decision makers to deal with the many different

348 Ibid, 1-4 and 65-68.
349 Ibid, 65-77.
350 Ibid, 65-77.
351 Ibid, 65-77.
352 Ibid, 65-77.
353 Maguire, above n 144, 47-48.

facets of fisheries management problems and allows for a wide choice of different solutions to be provided to managers.[354] The increase in understanding of problems and potential solutions from multiple viewpoints only serves to increase the flexibility that managers have in undertaking adaptive management.

One of the most fundamental shifts needed from current fisheries management practice is for the full incorporation of the social sciences into the decision making process.[355] To be able to solve the fisheries "problem" it is clear that the biological and physical sciences need help, from; economists who can assist in understanding the motivation of markets and fishermen, sociologists who help understand community motivations and lawyers who help create institutions to bring this knowledge together.[356] Outside of the integration of different scientific disciplines, it is important to allow different voices and forms of knowledge to have a say in decision making.[357]

As Johnston notes, "[science] research may ultimately produce a cure for most or all forms of cancer, but science unaided will never 'solve' the problems of fisheries management."[358] Although science is the dominate form of knowledge in international regional fisheries management, in many national systems the old adage that "there is no better knowledge than working knowledge" still runs true.[359] In those systems it is the fishermen, as those intimately involved with the fisheries that are considered one of the most vital sources of information.[360] Not only are they an important source of knowledge, but as those who will be affected by the management decisions, they are a vital audience if management is to be effective.[361] This philosophy has led to the development of

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354 Ibid, 47-48.
355 Garcia, above n 57, 93.
356 Johnston, above n 150, 157-162.
357 P. Jones, 'Equity, justice and power issues raised by no-take marine protected area proposals' (2009) 33 *Marine Policy* 759, 761-763.
358 Johnston, above n 150, 157.
359 Jones, above n 357, 761-763.
360 Ibid, 764-765.
361 Ibid, 764-765.

community and public participation.[362] One of the key drivers of the push toward increased participation is the growing realisation that those affected by fisheries conservation measures must be involved in the process of creating them if they are ever be effectively enforced.[363] In terms of non-expert information (perhaps better described as non-traditional expertise), FAO has concluded that best-practice management includes the greatest possible participation by all stakeholders.[364] Stakeholder participation is important for many reasons; first consultation with those who are affected by regulations gives to the regulated a sense of ownership. It also gives the process of regulation the legitimacy of democracy. These factors serve to increase compliance and add an additional input of knowledge to fisheries management.[365]

The benefit of including other forms of knowledge in the fisheries dialogue also includes improving science. It is clear that decision makers consider a range of factors other than science, unfortunately where these factors are not able to be expressed in the decision making forum then decision makers are forced to justify their decisions on alternate (often allegedly scientific) grounds. This devalues the decision and devalues science, as the independence of the science is destroyed by the inclusion of non-scientific factors. Conversely, where these influences can be aired, there is no need to cloak them in science and therefore the independence of the scientific process remains.

Features of Fisheries Science Management

Fisheries pose unique problems for scientists and managers. The marine environment is inherently uncertain and fluctuates through seemingly random cycles that are not completely understood. Scientists hold little hope of being able to quantify existing fisheries populations, let alone predict

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362 L. de Vivero, C. Mateos and D. del Corral, 'The paradox of public participation in fisheries governance. The rising number of actors and the devolution of process' (2008) 32 *Marine Policy*, 322-323.
363 Ibid, 322-323.
364 The Food and Agriculture Organization, 'Indicators for Sustainable Development of Marine Capture Fisheries', (FAO Technical Guidelines for Responsible Fisheries No 8, The Food and Agricultural Organisation, 1999) 10 and 54.
365 S. Jentoft, B. McCay and D. Wilson, 'Fisheries Co-management: Improving Fisheries Governance through Stakeholder Participation' in Grafton R. Q. et al (eds), *Handbook of Fisheries Management and Conservation* (Oxford University Press, 2010) 675, 675 and 683-683.

future numbers, and fisheries organisations are highly political, have many stakeholders and require decisions to be made with regard to a wide range of different knowledge sources. In order for fisheries to be effectively managed, interactions between the various components of governance need to be improved. There must be: improved information collection and distribution, a more inclusive interdisciplinary approach, a highly participative decision making process that integrates scientific knowledge with social and economic knowledge as well as the views of other stakeholders, scientific assessment of a broader range of policy options and an auditing mechanism.[366]

The current systems used for fisheries management have been developed over a long history, with the work for the modern system of fisheries management beginning after World War II. Throughout science and management have grown together, each influencing the other: when management has required something, science has aimed to deliver, where science has enabled something: management has taken advantage. Many of the current methodologies of fisheries management (such as the ecosystem approach or community management) reflect a new understanding of the interconnectedness and fragility of marine ecosystems in the face of large scale human exploitation. The ecosystem and the precautionary approaches are not unique to fisheries but given the global scale and importance of the marine environment, they are particularly relevant to it. In conjunction with these, science has developed a range of fisheries specific tools including ecosystem modelling and the integration of the economic and social sciences into the advice traditionally provided by nature science.

The opportunity to improve the interaction of science and management is particularly evident in RFMOs where scientific advice is at times not followed by decision makers. The integration of scientific knowledge into the management framework faces a number of challenges including: the perceived bias and non-independence of scientific advice, undue influence of external factors on

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[366] Garcia, above n 57, 93-96.

scientific advice, poor communication of scientific advice, a lack of responsiveness, a lack of legitimacy, a lack of relevance, and limited integration with other forms of knowledge.

In order to overcome these challenges science, management and regional fisheries institutions must be modified to properly support the integration of different forms of knowledge (including science) into fisheries decision making. A number of ways that could improve this integration have been derived from the surveyed literature. First the literature shows that different areas of knowledge must be assigned tasks that are suitable for them, science should not be asked to build political agreement, nor should politicians be tasked with undertaking independent scientific research. Secondly the decision making process (and science) must become more transparent in order to improve the legitimacy of science and make that advice more useful to decision makers in building consensus. Thirdly science must be allowed to be science. Science is an uncertain, rapidly developing discipline and therefore it should be allowed to change overtime and should not be hemmed in by institutional rules which only serve to limit the usefulness of scientific advisors. Finally other forms of knowledge, both expert knowledge (politics, economics, social science and behavioural science) and non-expert (stakeholder and community views) must be formally incorporated into decision making. These factors are clearly relevant to decision makers and where institutions ignore them or attempt to minimise their influence, they tend to incorporate them under the cloak of science, thus devaluing its usefulness.

Fisheries decision making is an archetypal example of many disparate streams of information and knowledge merging to form a coherent voice to manage a common resource. Given this, the "integration" of disciplines must be a foundational principle of any fisheries management institution and/ or its mandate or founding agreement. Legal instruments whether they be high-level multilateral treaties, agreements creating RFMOs or the internal working procedures of an RFMO, all must be cognisant of this integrative role and put into place suitable structures and processes to allow science to be effective and to be effectively integrated into the management process.

Chapter 3

The International Legal Framework for the Governance of Fisheries and its Relevance to the Use of Science

The regulation of fisheries has a long history, with custom, religion and legal frameworks all playing an important part in how the utilisation of marine resources has been controlled. In this context the role of international law in fisheries regulation is a relatively recent one. The International Law Commission began its consideration of fisheries in 1949 and arising from their deliberations, the first set of Law of the Sea Conventions were completed in 1958.[367] Although the subject of capture fisheries was one of the most important issues at the time, the matter was not (primarily due to Cold War politics), a large part of the final text of the 1958 Conventions[368] The Second United Nations Conference on the Law of the Sea (1960) also failed to resolve the outstanding fisheries issues, particularly the question of what breadth should be given to the territorial sea.[369]

It was not until the completion of the Third United Nations Law of the Sea Conference that a dramatic expansion of the international legal regime for fisheries management commenced. The multilateral treaties and other non-legally binding instruments that have followed the 1982 Law of the Sea Convention, have had an important influence on the use of science in regional fisheries management. It is these instruments, both binding and non-binding, that cement regional cooperation as the solution to managing marine fisheries (particularly those of highly migratory and high seas stocks). These instruments also create the legal framework that regional fisheries management and its institutions (such as RFMOs) exist within.

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367 International Law Commission, *Summary Records and Documents of the First Session including the report of the Commission to the General Assembly 1949*, [1956] Yearbook of the International Law Commission, 43-44.
368 T. Treves, *1958 Geneva Conventions on the Law of the Sea: Geneva, 29 April 1958* <http://untreaty.un.org/cod/avl/ha/gclos/gclos.html>.
369 Ibid.

This chapter will examine the multilateral treaties and related non-legal instruments which create the current legal framework for international fisheries management. It is this broad legal framework that articulates the use of science in marine fisheries management, and also recognises the importance of States cooperating in regional fisheries management organisations.

There are a vast number of instruments and political statements potentially relevant to fisheries management so some discretion as to what is included is inevitable. The aim has been to include the treaties and other documents that have most relevance to regional fisheries management today.

The historical origins of each instrument will be described in order to give context to the problems or issues within global and regional fisheries management that needed to be addressed. Furthermore, each discussion includes an examination of the use of science within the instrument, particularly where this specifically relates to regional fisheries management. The chapter intends to examine whether and how each fishery instrument impacts on the decision making framework of the RFMOs. This will be done by a comparison of the provisions within the instrument with the findings (described in the earlier chapters) on factors that encourage the effective use of scientific information in management. In turn, this discussion will necessarily inform the later chapters which deal with science and decision making within RFMO agreements themselves, by indicating the framework within which these organisations and agreements must operate.

The Origins of the International Law of the Sea

The beginnings of the modern law of the sea can be traced to one of the great legal debates of the seventeenth century over the question of whether the oceans were free or whether they could be owned in some way. This conflict between *mare liberum* and *mare clausum* was expressed in the works of Hugo Grotius and John Seldon.[370] For a long time the idea proffered by Grotius, that no State could own the ocean prevailed and the seas were open for any individual to trade, travel, and to

[370] M. Vieira, 'Mare Liberum vs. Mare Clausum: Grotius, Freitas, and Selden's Debate on Dominion over the Seas' (2003) 64(3) *Journal of the History of Ideas* 361, 361-362.

fish.[371] The Grotian freedom to fish was based on his assumption (prevalent at the time) that the seas were inexhaustible.[372] It was eventually realised that fish stocks were not unlimited, in the late nineteenth century there was the first acknowledgment that fish stocks were potentially exhaustible (in reality some already severely depleted). In the twentieth century, the difference between the naturally available supply and the insatiable demand for fish, led to fishing disputes between those States that fished in their coastal waters (resource adjacent nations or RANs) and those States with fleets that could travel the world in search of fish (distant water fishing nations DWFNs).[373]

This dispute between RANs and DWFNs resulted in many of the States with large fish stocks attempting to claim ownership (sovereignty) over them. The most powerful State to do this initially was the United States (US) which issued the Truman Proclamation in 1945.[374] This proclamation claimed a conservation zone over the areas contiguous to the US coast for the purposes of conservation of marine resources and protecting the interests of coastal fisheries.[375] The increased claim by the US was the basis for many other Coastal States to claim similar increases in ocean ownership.[376] The dispute between RANs and DWFNs and the potential for it to escalate made evident the need for a new legal regime of the oceans.[377] The Codification of the law of the sea would eventually be achieved by a series of United Nations sponsored conferences spanning nearly half a century which culminated in the creation of the *The United Nations Convention on the Law of the Sea* (‘*LOSC*’) that could be considered the constitution of the oceans.[378]

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371 D. Zeller, 'From Mare Liberum to Mare Reservarum: Canada's Opportunity for Global Leadership in Ocean Resource Governance' (2005) 19 *Ocean Yearbook* 1, 1-2.
372 Ibid, 4-6.
373 M. Dixon and R. McCorquodale, *Cases & Materials on International Law* (Oxford University Press, 4th ed, 2003), 348-349; A. Bearnerts, *Bernaerts' Guide to the 1982 United Nations Convention on the Law of the Sea* (Trafford, first published 1988, 2006), 2-5.
374 Presidential Proclamation No 2667, 10 F.R. 12303 (28 September 1945).
375 Ibid.
376 The United Nations Division for Ocean Affairs and Law of the Sea, *Historical Perspectives of Law of the Sea* <http://www.un.org/Depts/los/convention_agreements/convention_historical_perspective.htm>.
377 Bearnerts, above n 373, 2-5.
378 *The United Nations Convention on the Law of the Sea* opened for signature 10 December 1982, 1833 UNTS 3 (entered into force 16 November 1994) (‘*LOSC*’).

The 1958 Law of the Sea Conventions

The First United Nations Conference on the Law of the Sea

The first United Nations Conference on the Law of the Sea occurred in Geneva from February to April, 1958.[379] This conference was the result of a recognition, first by the League of Nations in 1930, and then by the General Assembly of the United Nations and the International Law Commission in 1949, that the legal regime of the oceans was a subject ripe for Codification.[380] The General Assembly gave the conference the task of "examining the law of the sea, taking into account not only the legal, but also the technical, biological, economic and political aspects of the problem."[381] This meant that science (in the form of technical and biological science) was to be a key consideration, as was, the integration of scientific, political and economic factors.

The conference ended with four conventions and one protocol being opened for signature: the *Convention on the Territorial Sea and Contiguous Zone* ('*CTS*'), the *Convention on the High Seas* ('*CHS*'), the *Convention on the Continental Shelf* ('*CCS*'), the *Convention on Fishing and Conservation of the Living Resources of the High Seas* ('*CFCLR*') and the *Optional Protocol Concerning the Compulsory Settlement of Dispute*s ('*OPSD*').[382] All entered into force in the 1960s and while they remain extant, they have to a degree been incorporated into and therefore over-shadowed by the later 1982 Law of the Sea Convention.[383] It is the *CFCLR* which is most relevant to understanding of RFMOs and their use of science for regional fisheries management.

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379 Treves, above n 368.
380 Ibid.
381 Ibid.
382 *Convention on the High Seas* opened for signature 29 April 1958, 450 UNTS 11 (entered into force 30 September 1962) ('*CHS*'); *Optional Protocol Concerning the Compulsory Settlement of Disputes* opened for signature 29 April 1958, 450 UNTS 169 (entered into force 30 September 1962) ('*OPSD*'); *Convention on the Continental Shelf* opened for signature 29 April 1958, 499 UNTS 311 (entered into force 10 June 1964) ('*CCS*'); *Convention on the Territorial Sea and Contiguous Zone* opened for signature 29 April 1958, 516 UNTS 205 (entered into force 10 September 1964) ('*CTS*'); *Convention on Fishing and Conservation of the Living Resources of the High Seas* opened for signature 29 April 1958, 599 UNTS 285 (entered into force 20 March 1966) ('*CFCLR*')
383 Treves, above n 368.

The 1958 Law of the Sea Conventions and the framework for Regional Fisheries Management

The *CTS* does not mention cooperation, but it does specify in Article 14(5) that fishing shall not be considered a right of innocent passage and therefore prohibited, without the permission of the Coastal State, within the territorial sea. The *CHS*, in Article 2(2), instead of limiting fishing, preserves the freedom of all States to fish in areas outside the territorial sea. There is a caveat on this freedom, which is that like other freedoms, the freedom to fish can only be exercised with due regard for the interests of other States which are exercising the same freedom. Arguably respect for the freedom of other States requires that the right to fish be exercised in a sustainable way so that the resource remains available for the use of other States.

The *CFCLR* was, due to its focus on economically valuable fishing rights more controversial than the other conventions, and thus there are a lower number of ratifications.[384] The topic of living resources was however an early consideration in the International Law Commission's work on Codification of the law of the sea.[385] At its first session on the codification of the law of the sea, the Commission asked Mr J. François to be the special rapporteur and to consider which areas of the law of the sea would usefully be codified.[386] In the Commission's third session on the topic, Mr François' report had the conservation of resources of the sea as its first consideration.[387] The Commission's draft articles on the conservation of living resources were considered by governments and the International Technical Conference of the Living Resources of the Sea, held in Rome from 18 April to 10 May 1955. In 1956, drawing on this previous work, the Commission

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384 Ibid.
385 International Law Commission, *Report of the International Law Commission on the Work of its Eight Session*, 4 July 1956, [1956], Yearbook of the International Law Commission, 2, 254.
386 Ibid, 254.
387 Ibid, 254.

published its draft articles, with a commentary which provided a useful insight into the creation of the Articles within the *CFCLR*.[388]

The second paragraph of the *CFCLR*'s preamble explains that the conservation of high seas living resources requires international cooperation rather than absolute freedom to fish. In the Commission's commentary to the draft articles it was accepted that absolute freedom of fishing would lead to 'the extermination of marine resources, and therefore the right to fish on the high seas did not prevent the creation of regulations for the conservation of marine resources.[389] The need for cooperation is specified in Article 1(2) of the *CFCLR* which states that "all States have a duty to cooperate with other States in order to adopt measures as required for the conservation of high seas living resources." This cooperation includes, as specified in Article 4, "entering into agreements for the conservation of resources that nations of one or more States fish for, to ensure the conservation of the stocks affected." The commentary shows that the Commission recognised that there would be some difficulty in enforcing cooperation and that for these agreements to occur, in a regime dominated by the freedom to fish, there would need to be consensus between all States involved in fishing for a particular stock.[390]

The 1958 Law of the Sea Conventions and the Use of Science in Fisheries Management

Article 2 of the *CFCLR* specifies that the first aim of conservation should be "to render possible the optimum sustainable yield of fishery resources so as to secure a maximum supply of food and other marine products." This Article is derived from the Commission's draft article 50, which defined conservation as "the aggregate of measures rendering possible the optimum sustainable yield from those resources so as to secure a maximum supply of food and other marine products."[391] The International Technical Conference on the Conservation of the Living

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388 Ibid, 254.
389 Ibid, 286.
390 Ibid, 286.
391 Ibid, 288.

Resources of the Sea, discussing draft article 50, stated that the "immediate aim of conservation of living marine resources is to conduct fishing activities so as to increase or at least to maintain the average sustainable yield of products in sustainable form."[392] This definition is clearly anthropocentric, in that the aim of management is not about conservation but rather maximising the yield for human consumption. Interestingly, it does include the idea that conservation should ensure not only the maximum yield today, but also consider the yield available to man in the future, a forerunner to the intergenerational sustainability recognised later in *the Rio Declaration*.[393]

The proper use of science is discussed in reference to the taking of unilateral emergency measures in Articles 7 and 8 of *CFCLR*. Article 7(2b) requires that "unilateral measures are based on *appropriate* scientific findings" (emphasis added). Article 8(1) requires States taking unilateral measures to "state the scientific reasons which in its opinion make such measures necessary". Article 10 of the CFLCR relates to the operation of the dispute resolution mechanism. It requires, in Sub-Article 1(a)(ii) that measures recommended by the dispute resolution authority be based on scientific findings. These Articles identify that "appropriate science" is the primary basis for justifying fisheries decision making. The commentary on the Commission's draft Article 58 (on which Article 10 of the *CFCLR* is based) gives some further clarification to what "appropriate science" might be.[394] That same commentary states that if scientific findings are to be 'appropriate', they must necessarily be 'effective'.[395] This reflects the need for management measures to be legitimate, which in part is based on effectiveness and requires science to be result orientated. Interestingly, Article 10(1)(a)(i) shows that the precautionary approach was certainly not in mind, with the requirement that "before the dispute resolution authority makes a recommendation

392 Ibid, 289.
393 Ibid, 288.
394 Ibid, 292.
395 Ibid, 292.

scientific findings must demonstrate the *necessity* of conservation measures", a decidedly opposing approach to modern precautionary management.[396]

The 1958 conventions, particularly the *CFCLR*, provide the first legal impetus for the use of science in international fisheries management. While the conventions encourage management decisions based on 'appropriate' and 'effective' science there are some aspects of the conventions which do not mesh well with the best use of science. The conventions give a clear political purpose for fisheries management (obtaining the maximum human benefit) which, in several Articles, is given more specificity as *optimum sustainable yield*. Optimum sustainable yield is an ecological/economic concept based on a single species calculation of maximum sustainable yield, modified for economic conditions. Having such a specific concept in a convention does not support the effective use of science as it can lock managers into an outdated concept. In practice, fisheries science has moved away from optimum sustainable yield and now favours the use of multispecies and ecosystem management. The evolution of scientific fisheries management could potentially be limited by outdated specific references in convention texts. The 1958 conventions make science the foundation of fisheries management but unfortunately do not create a mechanism to include other forms of knowledge in decision making; despite the FAO representative at the drafting committee clearly enunciating the importance of economic problems to fisheries management.[397] The absence of a legal framework for the use of sources of information other than science means that where there is scientific uncertainty or a lack of scientific advice there is a paucity of guidance. Despite these problems, the understanding created by the conventions that the freedom to fish is limited by the need for management based on a scientific

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[396] S. Marr, *The Precautionary Principle in the Law of the Sea,* Publications on Ocean Development (Martinus Nijhoff Publishers, 2003), 135.

[397] United Nations Conference on the Law of the Sea, *Official Records Volume V: Third Committee (High Seas Fishing: Conservation of Living Resources)*, 3rd Comm, 12th mtg, UN Doc A/CONF.13/41 (28 March 1958), 29-32.

(ecological) understanding of marine living resources, remains an important contribution to fisheries management.

The 1982 Law of the Sea Convention

Creation of the 1982 Law of the Sea Convention

Following the 1958 conference, the United Nations led a concerted effort to finish Codifying the law of the sea and to address the many important issues that had been left unresolved in the 1958 conventions.[398] These issues included the relationship between Coastal States and their living resources, and the relationship of both to distant water fishing nations.[399] The first attempt to resolve these was the Second United Nations Conference on the Law of the Sea in 1960, but this unfortunately led to no new law and added little to the dialogue of Codification.[400] Thirteen years later the Third United Nations Conference on the Law of the Sea commenced. The conference took nine years to reach a conclusion but managed to resolve many of the core issues hindering the conservation of living marine resources. The conference ended with the bible of ocean governance, the *LOSC*. The *LOSC* is a milestone in international law as it represents an unprecedented effort in Codifying customary law and reconciling the differing interests of states.[401] The *LOSC* provides a strong framework for cooperation in the oceans, giving guidance on the type, scale and purpose of cooperation. The articles in the *LOSC* provide the legal framework for regional fisheries management and the use of science in the management of marine living resources.

Within the *LOSC* there are provisions for the conservation and management of different fish stocks based on their; location, geographic spread and ecological characteristics, specifically:

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398 The United Nations Division for Ocean Affairs and Law of the Sea, above n 376.
399 Ibid 422; Bearnerts, above n 373, 2-5.
400 The United Nations Division for Ocean Affairs and Law of the Sea, above n 376; Bearnerts, above n 376, 5-7.
401 Dixon and McCorquodale, above n 373, 348-352.

- Articles 61 and 62 relate to fish stocks in the EEZ;
- Article 63 relates to fish stocks shared between the EEZs of two or more states, or shared between the EEZ and High Seas;
- Article 64 relates to fish stocks that are highly migratory species;
- Article 65 relates to the management of marine mammals in the EEZ (and the High Seas by virtue of article 120);
- Articles 66 and 67 (respectively) relate to the management of anadromous and catadromous stocks in the EEZ; and
- Articles 116, 117, 118 and in particular 119 all relate to purely High Seas fish stocks.

Cooperation and Regionalisation

While the freedom of the oceans does have a nostalgic appeal it has a situation akin to the archetypal tragedy of the commons.[402] Where competition between states previously characterised the history of the ocean, the *LOSC* cemented the doctrine of cooperation as representing the way forward (a process begun in the earlier 1958 conventions). Cooperation is the key to effective governance because no state can exercise effective control of the global oceans. [403]

The 1940s attempts to claim ownership of the oceans, were an attempt to resolve the tragedy of the commons by introducing private ownership.[404] The *LOSC* itself used the creation of sovereign rights (for economic purposes similar to ownership) as a part solution to the problem and Codified a 200 nautical mile EEZ, so that vast stretches of ocean resources were now (effectively for fisheries management) controlled by states.[405] The *LOSC* took the opportunity, in return for the

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[402] G. Hardin, 'Tragedy of the Commons' (1968) 162 *Science* 1243.

[403] E. Ostrom et al, 'Revisiting the Commons: Local Lessons, Global Challenges' (1999) 284 (9 April 1999) *Science* 278, 278; T. Dietz, E. Ostrom and P. Stern, 'The Struggle to Govern the Commons' (2003) 302 (12 December 2003) *Science* 1907, 1910.

[404] Presidential Proclamation No 2667, 10 F.R. 12303 (28 September 1945) 376; The United Nations Division for Ocean Affairs and Law of the Sea, above n 422.

[405] *LOSC*, Art 57.

granting of sovereign rights, to set out a range of associated responsibilities; including responsibility for the conservation and management of living resources.[406] The effectiveness of sovereign rights over fisheries resources to mitigate the tragedy of the commons is restricted in two important ways: first the exclusive economic zone does not encompass the entirety of the ocean resource, and secondly, fish stocks move between the jurisdictions of states, with fish themselves having no respect for national borders.[407] The solution that the *LOSC* provides to these limitations is a requirement for cooperation between states, a theme strongly repeated throughout the text. The cooperation that is required exists both within the EEZs and on the High Seas.

Within the EEZ Article 63 requires cooperation where State's EEZs share a fish stock and where a fish stock is shared between an EEZ and the High Seas.[408] The need for cooperation is reinforced in relation to highly migratory fish stocks (as defined in Annex 1 to the *LOSC*), which because of their transient nature, require strong cooperation between States in order to be managed effectively.[409] Finally, in relation to purely High Seas stocks, Article 118 provides that "States shall cooperate with each other in the conservation and management of living resources of the High Seas".[410] The *LOSC* like the *CFCLR*, recognises that these requirements of cooperation in conservation and management are limits on the freedom of fishing, where the right to fish is subject to the fulfilment of the obligations within the treaty.[411]

The *LOSC* specifically encourages cooperation, in fisheries management, at the regional and sub-regional level. In Article 63 it states that cooperation should be either direct or "through competent sub-regional or regional organisations".[412] Similarly in Article 64, the *LOSC* calls for States to

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406 *LOSC*, Art 56.
407 Ostrom et al, above n 403, G. Hardin, 'Extensions of "The Tragedy of the Commons"' (1998) 280(5364) *Science* 682, 682-683.
408 *LOSC*, Art 63, sections 1-2.
409 *LOSC*, Art 64.
410 *LOSC*, Art 118.
411 *LOSC*, Art 116.
412 *LOSC*, Art 63.

cooperate through appropriate "sub-regional or regional organizations" requiring States to create those organisations where none exist.[413] On the High Seas Article 118 stipulates that where the nationals of States exploit living resources, "they shall enter into negotiations to manage and conserve and cooperate to establish sub-regional and or regional fisheries organisations"'[414]

The *LOSC*'s solution to management of the world's fisheries is a mixture of exclusive sovereign rights to living resources within certain areas (the EEZ) and cooperation (through regional and sub-regional organisations) for those parts of the ocean not subject to exclusive sovereign rights. Cooperation is required because sovereign rights cannot alone be a solution in an ocean where fish stocks cannot be contained by fences, and the creation of institutional cooperative structures at the regional and sub-regional same level is an inevitable consequence. In that way the *LOSC* gives birth to RFMOs as institutional manifestations of the need to for States to cooperate.

The Aims of Fisheries Management

The *LOSC*, in addition to creating a framework for RFMOs, provides a framework for the use of science for fisheries management. It is important that science is not called on to make decisions about what the aim or goal of management should be, because those questions are most appropriately made by political bodies or in political documents. The *LOSC*, at paragraph four of the Preamble, clearly articulates the goal of fisheries management stating "[it is desirable to have a legal order for the oceans and seas which promotes] the equitable and efficient utilisation of their resources, the conservation of their living resources and the study, protection and preservation of the marine environment." This aim could be summarised as a balance between the use and conservation of living resources. The balance of conservation and use is emphasised further by paragraph five of the preamble which states the outcome should be the "realisation of a just and equitable international economic order which take into account the interests and needs of mankind

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413 *LOSC*, Art 64.
414 *LOSC*, Art 118.

as a whole." This places conservation (as did the *CFCLR*) within an anthropocentric framework where conservation is based on the benefit (economic and otherwise) to mankind in the long-term. The long-term is important because when living resources are sustained over time, they deliver a greater total outcome than short-term mining of the sea.

Within the *LOSC*'s EEZ provisions, Articles 61 provides for the responsibility of conservation while Article 62 provides for the right of utilisation.[415] This same balance is articulated in relation to shared and straddling stocks in Article 63(1) which provides that cooperation should ensure "the conservation and development of such stocks" and 63(2) provides that States should cooperate in measures "necessary for the conservation of these stocks".[416] Article 64 refers to highly migratory stocks, and requires that States cooperate "with a view to ensuring conservation and promoting the optimum utilisation."[417] In relation to the High Seas Article 116 gives States a right to fish, but also provides that the use of that right is subject to treaty obligations, including those *LOSC*, particularly the rights and duties in Articles 63-67.[418]

The *LOSC* does not provide a definition for either conservation or management but does state that the purpose of conservation of high seas fish stocks should be to "maintain or restore the population", this places a threshold limit on the utilisation of high seas stocks but it is in line with the management of coastal stocks as restoration will often be required before a stock can be "optimally utilised".[419] Based on this, the *LOSC* provides a considerable amount of guidance as to the aim and purpose of fisheries management at all levels. This guidance can be used by scientists in framing their advice and guiding research and therefore assists in removing the urge for scientific advisors to fill a vacuum of direction with their own judgements.

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415 *LOSC*, Arts 61-62.
416 *LOSC*, Art 63.
417 *LOSC*, Art 64.
418 *LOSC*, Art 116.
419 *LOSC*, Art 119.

Unfortunately some of the guidance on the use of science contained within the *LOSC* is too specific. Article 61 specifies the aim of fishery management measures shall be to restore or maintain harvested populations or species at levels that can produce Maximum Sustainable Yield (MSY), as qualified by other environmental or economic factors (commonly called Optimal Sustainable Yield (OSY))[420] Article 64(1) concerning highly migratory species requires that States "shall cooperate directly or through appropriate international organisations with a view to ensuring conservation and promoting the objective of *optimum utilisation* of such species throughout the region" (emphasis added). Articles 66 and 67 concerning anadromous stocks and catadromous stocks respectively do not use the terminology of MSY or OSY and instead use the more generic "ensure their conservation through appropriate measures" language in Article 66 and ensuring "the rational management of the species" (presumably rational here means management via reason, including scientific reason) in Article 67. Article 119, referring to the high seas, includes the same requirements as Article 61 (referring to the EEZ), for States to "take measures which are designed, on the best scientific evidence available to the States concerned, to maintain or restore populations of harvested species at levels which can produce the maximum sustainable yield, as qualified by relevant environmental and economic factors, including [the interdependence of stocks and any generally recommended international minimum standards]." This is a OSY approach with an ecosystem management modification in Sub-Article 1(b) which requires that any measures "take into consideration the effects on species associated with or dependent upon harvested species with a view to maintaining or restoring the population of such associated or dependent species above levels at which their reproduction may become seriously threatened."

The use of MSY or OSY is inappropriate in framing management objectives as they represent specific scientific reference points, which, while designed to achieve particular management

420 M. Nordquist et al (eds), *United Nations Convention on the Law of the Sea 1982: A Commentary (II)* (Martinus Nijhoff Publishers, 2002), 635.

outcomes, are subject to the same reassessment and evolution that all scientific principles are subject to.[421] MSY and OSY were developed as numerical reference points which scientists believed could lead to fish stock utilisation that was sustainable over time.[422] Unfortunately, while this approach is set in the stone of the *LOSC*, science has moved on and now there is agreement that managing fisheries for MSY or OSY will not lead to sustainable outcomes.[423] The inclusion of MSY and OSY within the text of the *LOSC* shows the importance of ensuring that specific scientific ideas or scientific methodologies only occur in instruments that can be changed as rapidly as scientific consensus changes. The addition of ecosystem considerations in *LOSC* (Articles 61 and 119) is an improvement on the *CFCLR*, but it is still incorporating a current scientific paradigm that will perhaps change as science advances and therefore can easily become out-of-date. Additionally, it leads to the complexity that harvested species are to be maintained at levels which produce MSY (a scientifically determined reference point) but related stocks are only maintained at levels that ensure that reproduction is not seriously threatened (a non-scientific objective). Of course a contradiction occurs where to one RFMO a species is a target stock, but to another it is a non-target but related species, as may happen where a species based RFMO overlaps jurisdiction with a geographically based RFMO (for example the Western Central Pacific Fisheries Commission which is a tuna body and the non-tuna South Pacific Regional Fisheries Management Organisation). While MSY or OSY wording may in some circumstances allow an RFMO to adopt the ecosystem approach (currently favoured by scientific consensus), it remains vulnerable to the fundamental inevitability of change within the scientific community.

The Facilitation of Science

While treaty texts should not lock in scientific ideas, they can provide useful guidance on how science is to be used within decision making. Article 61 of the *LOSC* requires States to "[take] into

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421 Mace, above n 257, 4-10 and 28.
422 Ibid, 4-10.
423 Ibid, 5-12.

account the best scientific evidence available" and clarifies that this includes "scientific information, catch and fishing effort statistics and other data relevant to the conservation of fish stocks" exchanged by all States concerned, all of which supports the role of science in decision making. In terms of the process of creating the "best scientific evidence", it is clear that it is the community of the scientifically trained that are best placed to critique the methodology of science (as opposed to the outcomes which we all may critique). Article 119 attempts to include the idea of scientific best-practice by its reference to consideration of any "generally recommended international minimum standards". This may be seen as being synonymous with scientific consensus, but it is constrained by the limitations inherent in the remainder of the Article. This is unfortunate because the drafters of the *LOSC* did provide for the use of science in a more adaptable way within Article 204 concerning marine pollution. Here, the wording provides that States are to "observe, measure, evaluate and analyse, by *recognised scientific methods*, the risks or effects of pollution on the marine environment" (emphasis added). The approach taken in Article 204 does not limit the methods of science to those used today (or yesterday) except in so far that the methodology used must be recognised, presumably, and most sensibly, by other scientists. This approach appears to be both capable of adapting to change within the scientific community and allowing for peer review, the process by which much scientific methodology is quality controlled. Interestingly, the Nordquist edited commentary of the *LOSC* states that both the word "scientific" and the word "recognised" were put into the text for primarily stylistic reasons.[424]

Science, such as the complicated ecological modelling that is used in fisheries management, can require substantial data and expertise. Cooperation and sharing of resources is a cost-effective method of ensuring that the necessary expertise and data are available.[425] The *LOSC* encourages: cooperation in scientific research, data sharing and maritime technology exchange, all of which

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424 M. Nordquist et al (eds), *United Nations Convention of the Law of the Sea 1982: A Commentary (IV)* (Martinus Nijhoff Publishers, 2002), 114.
425 Bearnerts, above n 373, 2-5.

support the science used in fisheries management.[426] *LOSC* Articles 242, 243 and 244 all state that it is the responsibility of States to create favourable conditions for science and the sharing of ideas.[427] As with management, this cooperation is to be achieved directly or through regional bodies.[428] Scientific cooperation, unlike management, can be achieved not only in RFMOs but also regional fisheries bodies (RFBs) that are purely advisory in nature and which provide assistance with sharing knowledge. Advisory bodies engaged in sharing knowledge can provide a valuable resource to developing nations who often struggle to fund the science and technology necessary for effective fisheries management.[429]

Assistance to developing States is important for regional fisheries management as they do not often have the necessary financial resources to provide the science capability required to engage in effective management.[430] This requirement arises not only due to a lack of financial resources but also because in many cases developing States also have responsibly for fisheries management in vast areas of the ocean. Developing States therefore rightly require assistance both in meeting their obligations under international law and in effectively participating in RFMOs.[431] The need to support developing States is recognised in the *LOSC*, specifically in Articles 202, 203 and 207, where States are called on to assist developing nations with scientific research, pollution prevention and marine technology transfer. Additionally, Article 119 provides that when managing fish stocks on the High Seas, States shall consider "the special requirements of developing States" and ensure that management measures do not "discriminate in any form or in fact against the fishermen of any State". The Articles attempt to overcome the resources difficulties faced by many developing States participating in RFMOs by asking those who have access to effective science to share it with

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426 *LOSC*, Art 200.
427 *LOSC*, Arts 242, 243 and 244.
428 *LOSC*, Arts 260 and 271.
429 *LOSC*, Art 202.
430 Lugten and Andrew, above n 248, 32.
431 Ibid 18-22 and 25.

those in need. This approach of sharing and of attempting to enable developing States to participate in science aids the acceptance of fisheries science and the compliance with management measures based on it. Where more States are involved in science, the science has more legitimacy having a greater impact on management decision making and adding to the legitimacy of any arising management measures.

The 1993 Compliance Agreement and the 1995 Code of Conduct for Responsible Fisheries

Origin and Scope of the Instruments

The 1991 meeting of the Committee on Fisheries (COFI) called for "new concepts which would lead to responsible, sustained fisheries".[432] Following this, the International Conference for Responsible Fishing, held in Mexico in 1992 called for a Code of Conduct that would address the global concerns on the need for more responsible fishing, particularly in the lead-up to the United Nations Conference on Environment and Development (UNCED – the Earth Summit).[433] In 1993 of the FAO conference of parties took up this cause and adopted the *Agreement to Promote Compliance with International Conservation and Management Measures by Fishing Vessels on the High Seas* ('*the Compliance Agreement*') and in 1995 the same conference of parties adopted *the FAO Code of Conduct* for Responsible Fisheries ('*the FAO Code of Conduct*'), both instruments are designed to work together.[434]

The Compliance Agreement entered into force in 2003 and aimed to increase the level of compliance with the *LOSC* with a focus on the responsibilities of flag and port States, and on the creation of a record of fishing vessels.[435] The impact of *the Compliance Agreement* has been relatively limited as

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432 *The FAO Code of Conduct*, preface.
433 *The FAO Code of Conduct*, preface
434 *The FAO Code of Conduct,* preface; Agreement to Promote Compliance with International Conservation and Management Measures by Fishing Vessels on the High Seas adopted November 1993, 2221 UNTS 91 (entered into force 24 April 2003) ('*The Compliance Agreement*').
435 *The FAO Code of Conduct*, Art 1.

few parties have ratified it and fewer have fully implemented its provisions.[436] Although not legally binding, *the FAO Code of Conduct* has played an important role in the development of fisheries management by providing detailed guidance and best-practice.[437] The Code of Conduct draws its provisions from broader environmental instruments such as *the Rio Declaration* and UNCED's Agenda 21 and applies them to fisheries.[438] This section will examine *the FAO Code of Conduct* in the areas of cooperation, regional management, management principles and principles on developing countries, and where applicable will also discuss the impact of *the Compliance Agreement* on the framework for regional fisheries management.

The Code of Conduct and the Framework for Regional Fisheries Management

The Code of Conduct calls for cooperation at the global, regional and subregional levels, to ensure responsible fishing and to ensure an effective balance of conservation and utilisation.[439] Cooperation is highlighted in Article 2 which states that the aim of the instrument is to "facilitate and promote technical, financial and other cooperation in the conservation of fisheries resources and fisheries management." Article 7.1.1 of *the FAO Code of Conduct* supports this by further stipulating that States should take action at the "local, national, sub-regional or regional levels" and 7.1.3 argues that States should work through "bilateral, subregional or regional fisheries organisations" for the conservation of trans-boundary stocks. The Code of Conduct, however, calls for regional and subregional management organisations to be formed wherever a fisheries resource occurs outside of national jurisdiction or, where it occurs both within and outside of the jurisdiction.[440]

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436 The Food and Agriculture Organization, *The Code of Conduct for Responsible Fisheries Website* (2010) <http://www.fao.org/fishery/ccrf/en>.
437 Ibid.
438 *The FAO Code of Conduct*, Art 3 (c).
439 *The FAO Code of Conduct*, Art 6.12.
440 *The FAO Code of Conduct*, Art 6.

The Code of Conduct defines the scale of cooperation by stating that regional management should be conducted to take in the entire stock being managed.[441] Having the entire stock managed by a fisheries management body requires either global or regional fisheries management and hence supports the current framework of RFMOs which manage stocks at this scale. In defining the scale of that cooperation, the Code calls for the organisations to comprise all of those States in whose jurisdiction the resource occurs and for all other States to comply with the fisheries conservation measures of the organisation.[442] The link in the Code between the scale of cooperation and the characteristics of the stock or ecosystem being managed provides a clear basis for the RFMOs existence as an organisation appropriate to manage fish stocks and ecosystems that are regional in nature.

The Compliance Agreement and the Framework for Regional Fisheries Management

The preamble to *the Compliance Agreement* states that "under international law as reflected in the United Nations Convention on the Law of the Seas, all States have a duty to take*, or to cooperate with other States in taking* [measures to conserve living resources]" (emphasis added) through global, regional or subregional bodies. *The Compliance Agreement* discussed cooperation in three contexts: First, Article V deals with the sharing of information relating to vessels' compliance with international conservation and management measures. Second, Article VI deals with sharing information to aid in enforcement. Finally, Article VII deals with supporting developing nations. While *the Compliance Agreement* also encourages regional bodies to take an active role in promoting compliance with the *LOSC*, regional bodies are not the focus of its attention.[443] *The Compliance Agreement* is focused on international law enforcement, and accordingly, it does not discuss how science should be used by regional bodies. Of all modern fishery instruments, due to its low level

441 *The FAO Code of Conduct*, Art 7.3.1.
442 *The FAO Code of Conduct*, Art 7.
443 *The FAO Code of Conduct*, Art 1.

of international acceptance, *the Compliance Agreement* is really only of relevance in so far as it has shaped later legal arrangements.

The Code of Conduct and the Use of Science for Regional Fisheries Management

The Aims and Objectives of Fisheries Management and Science

The Code of Conduct (like the *LOSC*), recognises that there is a right to fish, but that the right carries with it the obligation to do so in a responsible manner.[444] By applying the principles of *the Rio Declaration*, the Code calls for fisheries management to apply intergenerational equity and ecosystem sustainability.[445] As with the *LOSC*, *the FAO Code of Conduct* remains anthropocentric and Article 2 of *the FAO Code of Conduct* states the objective of "promoting the contribution of fisheries to food security" while "promoting the protection of living aquatic resources and their environments". In terms of objectives *the FAO Code of Conduct* provides greater detail than earlier instruments. It also provides descriptions or definitions of previously undefined or controversial terms. Importantly, sustainable use is defined as management that allows depleted stocks to recover.[446] The Code was written in a time that predates the intense global attention that is currently given to climate change, but its flexible provisions have relevance and application to climate change and other natural phenomena that can impact on sustainability. Thus, Paragraph 7.5.5. states:

> If a natural phenomenon has a significant adverse impact on the status of living aquatic resources, States should adopt conservation and management measures on an emergency basis to ensure that fishing activity does not exacerbate such adverse impact. States should also adopt such measures on an emergency basis where fishing activity presents a serious threat to the sustainability of such resources. Measures taken on an emergency basis should be temporary and should be based on the best scientific evidence available.[447]

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444 *The FAO Code of Conduct*, Art 6.1.
445 *The FAO Code of Conduct*, Art 6.2.
446 *The FAO Code of Conduct*, Art 7.2.2(e) and 7.6.10.
447 *The FAO Code of Conduct*, Art 7.5.5.

Though this Article only allows for emergency short term measures it does provide the basis for a principle that fisheries management should take into consideration external, natural, influences on the fishery when deciding on management measures and continues the use of the terminology *best scientific evidence available* in relation to the application of measures taken.

The Use of Science for Fisheries Decision Making

The Code of Conduct encourages decisions based on scientific reasoning, the implementation of the precautionary approach at all levels of management and the minimisation of impacts on ecosystems.[448] The use of science for fisheries management is clearly articulated in Article 12.13 where "States should promote the use of research results as the basis for the setting of management objectives, reference points and performance criteria, as well as ensuring adequate linkage, between applied research and fisheries management". While science is an important basis for fisheries management, science should not set fisheries objectives. Rather, science should provide advice on how to meet the fishery objectives. Any move to have science decide on a management objective risks politicising the science which could damage both the fisheries science and the management measures based on it. Fortunately, in terms of decision making *the FAO Code of Conduct* calls for any determination of fisheries measures to occur in a transparent way. This is a key factor in increasing the effectiveness of both fisheries science and management by making both more legitimate.[449]

The Code of Conduct suggests that conservation and management decisions should be based on the best scientific evidence available with the addition of the precautionary approach for cases of scientific uncertainty.[450] The formulation of "best scientific evidence available" is a useful one as it allows for continual development which is a quality that characterises science. Instead of requiring

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[448] *The FAO Code of Conduct*, Art 6.7.
[449] *The FAO Code of Conduct*, Art 7.
[450] *The FAO Code of Conduct*, Art 7.1.1.

managers to look through the prism of a single scientific device such as MSY or OSY, it allows decision makers to utilise the scientific best-practice of the time thereby being ready for both gradual change and scientific revolution. Unfortunately in places the definitions in *the FAO Code of Conduct* are overly specific due to the influence of the *LOSC*. Thus, Article 7.1.1 of *the FAO Code of Conduct* states that measures should have the objective of "optimum utilization" and Article 7.2 calls for measures which aim to maintain or restore stocks at levels capable of producing MSY.

The Utilisation of Advice other than Scientific Advice

The Code of Conduct makes specific reference to the use of a variety of different forms of expertise in fisheries management and the importance of considering the different aspects of the fisheries problem. In Article 2 *the FAO Code of Conduct* states that one of its objectives is to "[take] into account all the relevant biological, technological, economic, social, environmental and commercial aspects" of fisheries. This is reiterated in Article 6.4 which calls for conservation and management decisions to be based on scientific evidence, but taking into account "traditional knowledge of the resources and their habitat, as well as relevant environmental, economic and social factors". This is a clear recognition of the importance of considering a wide range of knowledge sources when examining a multifaceted problem. The consideration of these different sources of knowledge increases the legitimacy of the decision making process itself, by being more participatory, thereby increasing its effectiveness.[451]

[451] See also *The FAO Code of Conduct* Art 7.4.5 and 12.

The 1995 Agreement for the Implementation of the Provisions of the United Nations Convention on the Law of the Sea of 10 December 1982 Relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks

The *UNFSA* entered into force in December 2001 and has since received wide support with 82 parties to the convention.[452] The creation of the UNSFA recognises the special needs of fish stocks that straddle and transit different jurisdictions, and recognises the special vulnerability of these stocks to the tragedy of the commons.[453] Like the *LOSC*, it aims to solve these issues through cooperation, in the case of the UNSFA, particularly through RFMOs, and it promotes the objectives of conservation and sustainable use.[454] The *UNFSA* is limited to straddling or highly migratory fish stocks so does not apply to the operation of all RFMOs.[455]

The *UNFSA* Framework for Regional Fisheries Management

The *UNFSA* requires States to cooperate in order to conserve and manage migratory fish stocks, and notes that in order to best achieve this, a State's right to fish on the high seas is limited.[456] Fish stocks are to be managed through regional or subregional organisations and only those States that cooperate with the conservation measures of the relevant organisation shall have the right to fish that stock.[457] The *UNFSA* also contains an obligation that if no relevant regional or subregional organisation exists, States should endeavour to create one.[458]

The *UNFSA* emphasises the central importance of regional and sub-regional organisations (that is RFMOs) to the management of migratory and straddling fish stocks, and because of this it

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452 The United Nations, *Signatures and Ratifications for the 1995 United Nations Fish Stocks Agreement*, <www.un.org/Depts/los/reference_files/status2010.pdf>.
453 Hardin, above n 407.
454 *UNFSA*, Art 5.
455 *UNFSA*, Art 3.
456 *UNFSA*, Art 7.
457 *UNFSA*, Art 8.
458 *UNFSA*, Art 8.

contains guidance on the structure and requirements of those organisations. RFMOs are required to have agreed on the stocks to be managed, the area of application, the relationships to existing organisations and on mechanisms for scientific decision making.[459] The UNSFA states that RFMOs should be empowered to enact conservation and management measures and agree on fisheries allocations.[460] Additionally it requires transparent decision making and the adoption of minimum standards for fisheries operations.[461] The *UNFSA* unlike earlier agreements goes much further than simply calling for cooperation at the regional level, it provides detail as to the functions of RFMOs and on the structure that they should have in order to exercise these functions.

The Use of Science in Fisheries Management

As with other treaties, the *UNFSA* provides that the objective of fisheries management should be a balance between conservation and use. The Preamble of the *UNFSA* states the parties are "determined to ensure the long-term conservation and sustainable use of the straddling fish stocks and highly migratory fish stocks". This same wording is used in Article 3 which lays out formally the objective of the convention. There are further objectives contained within Article 5, namely: the "protection of biodiversity"; the "minimisation of pollution, waste, and bycatch"; the "conservation of related species" and the "promotion of scientific research". The clear and consistent theme of sustainable use through the *UNFSA* and other instruments should, if accepted by managers, stakeholders and scientists, provide guidance to all on what their aims should be, and how RFMO performance can be measured against these aims.

While the *UNFSA* requires that decisions are "based on best scientific evidence" it also states that catch levels should maintain or restore fish stocks to a level that can support MSY taking into account ecosystem and social needs.[462] As discussed above *vis a vis* other instruments, the use of

[459] *UNFSA*, Art 9.
[460] *UNFSA*, Arts 10 and 12.
[461] *UNFSA*, Arts 10 and 12.
[462] *UNFSA*, Art 5.

scientific terminology such as MSY is problematic as it describes a scientifically defined objective and methodology for measuring an objective that is prone to be overtaken by scientific development. However, Article 5 of the *UNFSA* does bring MSY somewhat up to date with current scientific thinking by recognising that MSY must be qualified by relevant environmental factors and the interdependence of stocks. While these factors mean that the aim is more up to date, it does not solve the problem of science moving faster than the law.

In terms of the ecosystem approach to management, Article 5 of the *UNFSA* calls for the reduction of by-catch and wastage and for the consideration of species other than target species. Yet, the UNSFA is far from incorporating an approach of managing an ecosystem as opposed to single or related stocks. Article 5 (e) states that parties will:

> adopt, necessary, conservation and management measures for species belonging to the same ecosystem or associated with or dependent upon target stocks, with a view to maintaining or restoring populations of such species above levels at which their reproduction may become seriously threatened.

This consideration of related species is a significant improvement on a purely single species approach to managing fisheries, but it fails to consider the system as a whole and does not consider the situation, where multiple species in a system are targeted and not all can be managed for MSY. Further, this type of detail on implementing the barely defined ecosystem approach risks inconsistency with the objectives of MSY or OSY because as the understanding of the ecosystem increases there is a clear possibility that the management of related species as described above could lead to poor sustainable use outcomes.

Under the *UNFSA,* science is clearly envisaged as a central discipline to RFMOs. Article 10 (d) provides that a function of a RFMO is to "obtain and evaluate scientific advice, review the status of stocks and assess the impact of fishing on non-target and associated or dependent species". Article 10 (g) then requires that RFMOs "promote and conduct scientific assessments of the stocks and relevant research and disseminate the results thereof". Both Articles give science the role of advisor as to the current situation but unfortunately do not specifically provide for scientific evaluation of proposed solutions to conservation and management problems (a risk analysis role for science in management). As in other agreements, States are called upon to cooperate in relation to scientific research and data collection.[463]

Article 6 of the *UNFSA* elaborates on the precautionary approach, stating that incomplete data should not be a reason to avoid imposing measures to protect fish stocks.[464] Rather, uncertain or unreliable data is a reason (according to the *UNFSA)* to take additional conservation measures. Importantly, it states that where fish stocks are subject to an external event that could have an impact on their levels, emergency measures should be taken to better protect the stock. Annex II of the agreement provides detailed guidance on how a precautionary approach can be implemented including the use of precautionary reference points and the setting of precautionary limits.[465]

Annex I of the *UNSFA* provides detailed requirements for the collection and sharing of data. The collection and sharing of data from commercial and government fishing operations is vital for effective fisheries science because it is unlikely that data collected from scientific assessments would be sufficient to allow the robust assessments required for managers. The Annex sets out in relatively general terms the types of data that should be collected and the required standards. It requires that data be collected from all vessels flagged to a State in accordance with the operational characteristics of the vessels (noting that long-line vessels will collect different data to vessels using nets), it requires that the data go through some process of verification and that the data be formatted or collated in such a way as to allow sharing and statistical analysis.[466] The general nature of these requirements is beneficial because overtime the specific requirements for collection, verification and statistical analysis vary as scientific methods and management questions change.

463 *UNFSA*, Art 14.
464 *UNFSA*, Art 6.
465 *UNFSA*, Annex 2.
466 *UNFSA,* Annex I, Arts 2(a)-(e).

The most far reaching requirement is in Article 7 of the Annex which provides that States *must* share data through relevant regional or sub-regional organisations. This has obvious relevance for RFMOs as all, even those with independent scientific advisors, require fisheries data from States. While it is clearly relevant to RFMOs, it has likely had limited importance in practice. Data sharing is central to the work of RFMOs all of the legal frameworks studied for this thesis include detailed data sharing requirements.

Developing States

The *UNFSA* recognises the important needs of developing nations and calls for the management of allocations to take into account the needs of developing nations and artisanal fisheries.[467] Like earlier agreements it also asks States to support developing nations to implement the *UNFSA* and to develop scientific capacity.[468] As part of the assistance to developing nations the agreement sets up an assistance fund to provide aid to developing countries for the purpose of implementing the convention.[469] The fund was established by the United Nations General Assembly who also gave FAO the management responsibility for the fund.[470] The fund also aims to assist developing nations to participate in international fisheries forums including regional and sub-regional organisations.[471] Any developing State that is a member of the agreement can apply for assistance from the fund either directly or through a RFMO.[472] This is important for science as scientific knowledge can be expensive to obtain, it means that States without resources are able to effectively

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[467] *UNFSA*, Arts 24-26.
[468] *UNFSA*, Arts 2 and 25.
[469] *UNFSA*, Part VII.
[470] *Sustainable fisheries, including through the 1995 Agreement for the Implementation of the Provisions of the United Nations Convention on the Law of the Sea of 10 December 1982 relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks, and related instruments*, GA Res 58/14, UN GAOR, 58th sess, Agenda Item 52b, UN Doc A/Res/58/14 (21 January 2004) para 10.
[471] Ibid, para 9.
[471] P. Sand, 'International Environmental Law After Rio' (1993) 4 *European Journal of International Law* 377, 377; J. Palmer, 'The Earth Summit: What Went Wrong at Rio?' (1992) 70(4) *Washington University Law Review* 1005, 1012-1015.
[472] Further to this assistance a range of States also have programs to assist developing nations with fisheries matters in relation to the agreement for examples see www.un.org/depts/los/convention_agreements/fishstocksmeetings/compilation2009updated.pdf.

participate in scientific committees or dialogues at RFMOs where they otherwise would have difficulty in doing so. Ineffective participation by developing States in the work of RFMOs due to resource constraints risks making the scientific process less participatory and therefore less legitimate. It also risks making science less understandable to, and therefore less effective in guiding, decision makers.

The United Nations Conference on Environment and Development 1992

In June 1992, the UN convened in Rio de Janeiro the United Nation Conference on Environment and Development (UNCED), which was attended by both States and non-governmental organisations.[473] The conference was not as successful as hoped with many arguing that States pursued self-interest above the need to protect the environment.[474] Still the UNCED was a key environmental conference and the principles enunciated there have lived on and have both instigated and set the tone for environmental law in the subsequent period.[475]

The 1992 Rio Declaration

The *1992 Rio Declaration Environment and Development* (*the Rio Declaration*) is a widely accepted non-legally binding instrument which provides guiding principles for sustainable development and summarises the outcomes of UNCED.[476] The declaration, like many non-legally binding instruments, contains lofty general statements without providing detail, or legally enforceable measures.[477]

The Rio Declaration reiterates some fundamental principles relevant to the fisheries management framework. It reaffirms the principle from the *LOSC* that while States have the right to exploit their own resources there is a concurrent responsibility for sustainable use. The enunciation of this

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473 Sand, above n 471, 377.
474 Palmer, above n 471, 1012-1015.
475 Ibid, 1016; See also Agenda 21: Program of Action for Sustainable Development adopted 14 June 1992, UN GAOR, 46th Sess., Agenda Item 21, UN Doc A/Conf.151/26 (1992) (Agenda 21).
476 Sand, above n 471, 381-382.
477 Palmer, above n 519, 1015-1017.

principle places an emphasis on the needs of the most vulnerable, developing nations. This is an important principle for fisheries management in that it recognises that while wealthy and developing States may share a common responsibility for sustainable use, their responsibilities are differentiated according to their different capacities, including their capacity for science.

The Rio Declaration and the Framework for Regional Fisheries Management

The preamble of *the Rio Declaration* states that the goal of the document is to establish "a new and equitable global partnership through the creation of new levels of cooperation among States, key sectors of societies and people".[478] This goal reinforces the objectives of the *LOSC*, as it strives for equality among nations and increasing cooperation in the management of natural resources. Importantly, the cooperation is not just among States, but also among NGOs, civil society and peoples. Given that *the Rio Declaration* focuses on general environmental management, it does not, nor should it be expected to, delve specifically into fisheries management.

The Rio Declaration and the Use of Science in Fisheries Management

The first two principles of the Declaration follow on from the *LOSC* in that they enunciate the required balance between use and conservation, or right and responsibility. Principle one places humans at the centre of resource management, but limits their rights to those which are in harmony with nature. Similarly, principle two States that while humans have the right to utilise resources that right comes with the responsibility to not cause damage to the environment. These both reinforce that the aim of fisheries management has to be for the sustainable use of fish stocks.

The Rio Declaration provides one of the earlier statements of the precautionary approach, stating in principle 15:

> Where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measure to prevent environmental degradation.

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478 *The Rio Declaration*, preamble.

The precautionary approach is a centrepiece of modern environmental risk management and is key to effective decision making in RFMOs as it allows decision makers to act in the face of uncertain science. Another centrepiece of modern environmental science is the ecosystem approach in the preamble of *the Rio Declaration* which recognises “the integral and interdependent nature of the Earth, our home”.[479] This statement recognises the basis of the ecosystem principle, which is that the environment is interdependent and connected and cannot be managed in isolation. In fisheries management, this principle is vital given the high level of interconnectivity in marine ecological systems and between marine systems and social systems. Together, these principals espoused in the declaration provide the language that is used today in international law relating to the environment or resource management and therefore are also the language used within RFMO agreements and fisheries management itself.

The Convention on Biological Diversity

The *CBD*, (unlike *the Rio Declaration*) is a legally binding treaty. The *CBD* was opened for signature at the UNCED but did not enter into force until 29 December 1993. It currently has 196 State parties.[480] Despite its legally binding status and its clear goal of stopping or slowing the current extinction of species some involved in its conception have stated that the *CBD* will require a great deal of extra work if it is to be effective, as although it contains important principals, it lacks a strategy to prevent the problem of biodiversity loss.[481] The *CBD* contains numerous provisions that are relevant to the management of fisheries, including those which cover the sustainable use and protection of resources, cooperation, the ecosystem approach to management and marine protected areas.

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[479] *The Rio Declaration*, preamble.
[480] *Convention on Biological Diversity - List of Parties*, <https://www.*CBD*.int/information/parties.shtml>.
[481] Palmer, above n 471, 1024.

The Convention on Biological Diversity and Regional Fisheries Management

Cooperation is central to the *CBD* its preamble notes the need to promote, international, regional and global cooperation among States and intergovernmental organisations. Article 5 requires that States cooperate with each other and with international organisations with respect to areas outside of their jurisdiction or of mutual interest.[482] Articles 16, 17, 18 and 20 all enhance cooperation by providing for the sharing of information, scientific knowledge and financial resources, to assist developing States to achieve the goals of the *CBD*.

The Preamble of the *CBD*, along with Article 1, reaffirms the principles from earlier agreements that states are responsible both for using their biological resources in a sustainable manner and the conservation of biological biodiversity.[483] This theme continues in Article 3 where there is a balance between the right to use a resource and the associated responsibility to protect.[484] The practical approach to achieving this balance envisaged in the *CBD* is the ecosystem approach to management. The *CBD* provides for legal implementation of the ecosystem approach to management as a practical method of conservation. In the convention Article 10 (b) calls for States to adopt measures to minimise the risk to the ecosystem from the use of its biological components.[485] Supporting the protection of ecosystems, Article 8 calls for rehabilitation and restoration of degraded ecosystems recognising the fact that once an ecosystem becomes degraded it cannot be used as if it were fully functioning.[486]

The UNCED Legacy

The world community through the United Nations has continually reaffirmed its commitment to the goals of *the Rio Declaration* and the plan of action contained within the Agenda. First in 1997,

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482 *CBD*, Art 5.
483 *CBD*, Art 1.
484 *CBD*, Art 3.
485 *CBD*, Art 10(b).
486 *CBD*, Art 8.

the United Nations examined progress made in implementing the Rio instruments during their first five years of existence at Rio+5.[487] Rio+5 acknowledged that *the Rio Declaration* and Agenda had been unevenly implemented.[488] In response the UN passed a resolution that promised further action, stating in part:

> Time is of the essence in meeting the challenges of sustainable development as set out in *the Rio Declaration* and Agenda 21. To this end, we recommit ourselves to the global partnership established at the United Nations Conference on Environment and Development and to the continuous dialogue and action inspired by the need to achieve a more efficient and equitable world economy.

The world again came together to discuss issues of sustainable development in Johannesburg for *Earth Summit 2002* (otherwise called the World Summit on Sustainable Development).[489] This summit affirmed the global commitment to full implementation of *the Rio Declaration* and Agenda 21 by producing the Johannesburg Plan of Implementation which incorporated the commitment to implementation with commitments to other related instruments such as the Millennium Development Goals (to be later replaced the Sustainable Development Goals).[490]

In June 2012 Heads of State met again in Rio de Janeiro for the 2012 United Nations Conference on Sustainable Development (otherwise known as Rio+20). At this conference delegates discussed progress of meeting the goals from the original UNCED and agreed to re-intensify efforts toward sustainable development. The 2012 conference's primary outcome was a document titled "The future we want" which was endorsed by the General Assembly of the United Nations.[491] "The future we want" called for States to support *the FAO Code of Conduct*, the *UNFSA* and the *Agreement*

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[487] *Special Session of the General Assembly to Review and Appraise the Implementation of Agenda 21*, GA Res 51/181, UN GAOR, 51st sess, 86th plen mtg, Agenda Item 97 (b), UN Doc A/RES/51/181 (20 January 1997).
[488] *Program for the Further Implementation of Agenda 21*, GA Res S/19-2, UN GAOR, 19th spec sess, 11th plen mtg, Agenda Item 8, UN Doc A/RES/S-19/2 (19 September 1997).
[489] *Report of the World Summit on Sustainable Development, held in Johannesburg 26 August-4 September 2002*, UN Doc A/CONF.199/20.
[490] *Plan of Implementation, World Summit on Sustainable Development*, Johannesburg, September 2002, <http://www.johannesburgsummit.org/html/documents/summit_docs/2309_planfinal.htm>.
[491] *The future we want,* GA Res 66/288, UN GAOR, 66th sess, 123rd plen mtg, Agenda Item 19, UN Doc A/RES/66/288 (11 September 2012).

on Port State Measures to Prevent, Deter and Eliminate Illegal, Unreported and Unregulated Fishing ('The Port States Agreement').[492] In addition to supporting existing arrangements the document also spoke of a need for transparency and accountability in RFMOs and for the need of RFMOs to conduct regular reviews to improve their effectiveness.[493] No further detail was provided on what transparency and accountability measures may be suitable but both features can be assisted by a robust, independent and transparent scientific advisory mechanism. Interestingly, a large proportion of the resolution concerned fisheries management and particularly the management of highly migratory and high seas fish stocks, thus highlighting the importance of the stocks and the perceived problems with the effectiveness of current management measures.

The Agreement on Port State Measures to Prevent, Deter and Eliminate Illegal, Unreported and Unregulated Fishing

In late 2009 FAO, in conjunction with the Government of Canada, organised a series of conferences that led to the creation of a new treaty which aimed to empower port States to assist in enforcing compliance with measures aimed at preventing IUU fishing. This agreement is focused on enforcement through port measures, therefore it is not directly relevant to, or the use of, science in RFMOs. The agreement does however reinforce the objective of all fisheries management, the: "sustainable use and long-term conservation of both living marine resources and marine ecosystems".[494] This formulation includes an explicit reference to marine ecosystems in recognition of the importance of the ecosystem in supporting fish stocks. The agreement also recognises that regional and sub-regional organisations are vital for the effective implementation

492 *The Agreement on Port State Measures to Prevent, Deter and Eliminate Illegal, Unreported and Unregulated Fishing* adopted 23 November 2009, UNTS I-54133 December 2016 (entered into force 5 June 2016) ('*The Port States Agreement*').
493 *The future we want,* GA Res 66/288, UN GAOR, 66th sess, 123rd plen mtg, Agenda Item 19, UN Doc A/RES/66/288 (11 September 2012).
494 *The Port States Agreement*, Art 2.

of port State measures and calls for the sharing of information between countries and those organisations.[495]

Summary – International Law Related to Fisheries Management and the Use of Science

This chapter has had two aims. First, it has aimed to show how the international legal regime for marine capture fisheries has emphasised the need for regional cooperation as the proliferation of RFMOs is a result of this emphasis. Second, the chapter has aimed to analyse international instruments in order to observe how they envisage the interaction of fisheries science and management.

Several themes have become apparent. The first theme is the clear balance between a right (the freedom to fish) and responsibility (the duty of non-interference). There has since Grotius, the father of international law, been a freedom on the high seas, but there has also been a duty not to use freedoms to interfere with the rights of others. When this general principle of freedom subject to non-interference is applied to international fisheries (a sustainable resource, if used correctly) it becomes a right to fish, but only where such fishing is equitable between States, and equitable toward future generations. This can be seen in all the agreements beginning with the CFLCR and is strongly repeated in latter documents

The second theme is that the objective of capture fisheries is sustainable utilisation, an objective which runs through all agreements from 1958 to the present. This theme is related to the first in that as a renewable resource it can theoretically be used for all time (the principal of non-interference with the future) if used only to the extent that the resource can be replenished. This is repeated throughout all relevant agreements with similar language being used since the *CFCLR*. This is important for the use of science in RFMOs because science must be allowed to be science,

495 *The Port States Agreement*, Art 6.

it will not be effective where it is asked to be political or to make non-scientific decisions. In this case the objective for fisheries management is a political decision which a community or other body politic must decide upon, and thereafter science can help the community to achieve their objectives. Therefore, the provision of a clear goal such as 'sustainable use' is good for scientists, it lets them move away from political battles and focus on providing objective scientific advice on how to meet a politically determined objective. However, there are problems. Specifically many of the agreements discussed specify that OSY or MSY is the objective of fisheries management. While OSY and MSY may appear to be similar to statements such as sustainable use or balance between conservation and management, they are not merely aspirational goals, but scientific interpretations of sustainability. That is, MSY and OSY are scientific interpretations of sustainable use and are already out of date. This highlights the importance of ensuring that scientific detail is provided only in circumstances which allow for the process and speed of scientific change.

The third theme is, cooperation as the solution to the tragedy of the commons on the high seas. All the agreements examined have recognised that the oceans could not be managed without cooperation. The agreements have continued to reassert that States must cooperate and that cooperation is the only method with which to manage fish stocks. For fisheries management, cooperation is required in managing all stocks, those in the exclusive economic zone, those in the high seas and highly migratory stocks. Cooperation itself is required at the regional and sub-regional level, to match the ecological characteristics of the marine environment and fish stocks. Given the vast areas that a region encompasses in the ocean and the role of cooperation on agreeing to matters such as total allowable catch and conservation measurements, it is no surprise that the need to cooperate has led to the creation and proliferation of RFMOs.

The fourth and final theme is that science and scientific evidence must be the first (but not only) basis for making fisheries decisions. Each agreement examined provided that science was to be the basis for making decisions about the conservation or management of marine fisheries. The consensus in international law on this point is quite clear, for a decision to be made there must be some form of science to support it. There is only minimal detail on how that science is to be used which leads to several specific shortfalls when compared to the requirements for science to integrate with management. There are some problems with applying this theme. The first has already been discussed and it is the legal recognition given to the out-dated scientific tools of OSY and MSY. Linking the law with specific scientific ideas or methodologies does not allow for the inherent changes that will occur in scientific thinking. The result is science that is not best practice and leads to divisions amongst scientific advisors. Secondly, the agreements surveyed do not provide for transparency and accountability regarding the scientific advice provided to managers, or on the use of that science by decision makers. Thirdly the agreements contain no methodology for, or requirement to, improve the communication or salience of science provided to managers. Many of the agreements surveyed do not provide for the use of multiple forms of knowledge (exceptions include *the Rio Declaration* and the Fish Stocks Agreement). While it is good that science is a clear basis for decision making, it is important that other forms of knowledge (economics, social sciences, politics etc.) also have a formal voice for decision makers.

On a positive note, the instruments all facilitate cooperation on scientific issues, including the sharing of data, the sharing of research and cooperation in research projects and technological development. These are all vital to having 'best practice' science, as science is expensive and resource intensive. Any form of cooperation will help to reduce these costs, improve the quality of science and make science more widely available to developing nations which may not normally be able to afford it. Additionally the newer agreements, from *the Rio Declaration* onwards, do consider both the precautionary approach (not a scientific principle in itself, but a safety mechanism against faulty science) and they recognise the importance of ecosystem considerations. The international legal framework for fisheries management at the level examined here, despite the issues identified, provides an excellent basis for the use and integration of science into RFMOs. While there are many areas of integration and science use which are not addressed, these are more properly considered as matters for RFMO agreements to consider for themselves. The legal frameworks of RFMOs is the focus of the next chapter.

Chapter 4

Legal Arrangements of Regional Fisheries Management Organisations (RFMOs) and the use of Science

Regional Fisheries Management Organisations (RFMOs) are formed by multilateral treaties and have a legally binding intergovernmental instrument between States at their base. All of these treaties contain references to the role and use of science in the management of fish stocks. This chapter will introduce the RFMOs that constitute the core of this study and will examine how scientific principles have been incorporated into the basic documents of the RFMOs themselves. The discussion will seek to analyse how the different RFMO legal arrangements interact with science and how well those legal arrangements are aligned with best practice regarding the use of scientific information.

It is important to note that not all RFMOs are examined in this thesis. As a starting point this discussion is limited to marine capture RFMOs and does not consider inland fisheries. Additionally, it will not focus on those RFMOs which are essentially bilateral, such as the International Halibut Commission or the Pacific Salmon Commission, because these organisations face different political and decision making pressures than those in multilateral RFMOs. Finally it will focus on Area-Based Multi-Species RFMOs, rather than single-species or related-species RFMOs such as those which manage tuna and billfish species.[496] The reason for not examining the powerful Tuna RFMOs is that these organisations have been prolifically examined by other commentators and their inclusion was not necessary in order to examine a varied range of legal frameworks. In summary this chapter will deal with RFMOs that have jurisdiction over a range of species in a particular geographic area. The RFMOs considered in this chapter cover the globe, from the Southern Ocean to the North Atlantic. They are:

a. The Convention for the Conservation of Antarctic Marine Living Resources (CCAMLR) (which although not an official RFMO is a multilateral body with a wide geographic area and has the ability to make conservation and management measures).

b. The South Pacific Regional Fisheries Management Organisation (SPRFMO);

c. The South East Atlantic Fisheries Organisation (SEAFO);

d. The General Fisheries Commission for the Mediterranean (GFCM);

e. The Northwest Atlantic Fisheries Organisation (NAFO); and,

f. The North East Atlantic Fisheries Commission (NEAFC).

This group of RFMOs provides a wide variety of legal frameworks, from the very old (such as GFCM) to the new (SPRFMO). It also includes a variety of approaches to using science, from the use of an independent scientific advisor in NEAFC, to the predominate use of scientific advice from Member States in NAFO.

The Convention on the Conservation of Antarctic Marine Living Resources

The Antarctic has been commercially exploited for fish and marine mammals since the late 18th century. The *Convention on the Conservation of Antarctic Marine Living Resources* (‘*CAMLR Convention*’) was negotiated in conjunction with the Antarctic treaty process and entered into force in 1982.[497] There are currently 25 Member States and 10 acceding States; which represent many of the States active in Antarctic waters.[498] The Member States are: Argentina, Australia, Belgium, Brazil, Chile, and People’s Republic of China, European Union, France, Germany, India, Italy, Japan, Republic of Korea, Namibia, New Zealand, Norway, Poland, Russia, South Africa, Spain, Sweden, Ukraine, United Kingdom, United States of America and Uruguay. [499]

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497 Convention on the Conservation of Antarctic Marine Living Resources opened for signature 20 May 1982, 1329 UNTS 48 (entered into force 7 April 1982) (‘*CAMLR Convention*’); CCAMLR, *General Introduction* <http://www.ccamlr.org/pu/e/gen-intro.htm>.

498 CCAMLR, *Members - CCAMLR* <http://www.ccamlr.org/en/organisation/members>.

499 Ibid.

The role of CCAMLR is to provide a framework for managing the living resources within Antarctic waters.[500] Antarctic waters themselves are defined as the ocean area south of 60 degrees latitude and to the Antarctic marine living resources of the area between that latitude and the Antarctic Convergence which forms part of the Antarctic marine ecosystem.[501] This area represents 10% of the world's oceans and includes a variety of different ecosystems and climatic zones.[502] The Convention creates a Commission which has the role of furthering the aims established within the Convention.[503] This includes taking an active role in developing the knowledge necessary to manage living resources, in setting catch limits, and monitoring catch and compliance, however, enforcement is left to individual States.[504] In these roles the Commission is supported by a secretariat that is located, relatively close to the Southern Ocean, in Hobart, Tasmania.

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500 Excluding marine mammals, which are managed by the International Whaling Commission.
501 *CAMLR Convention*, Art I.
502 CCAMLR, *Convention Area* <http://www.ccamlr.org/en/organisation/convention-area>.
503 *CAMLR Convention*, Art XI.
504 CCAMLR, *Commission* <http://www.ccamlr.org/pu/e/cc/intro.htm>.

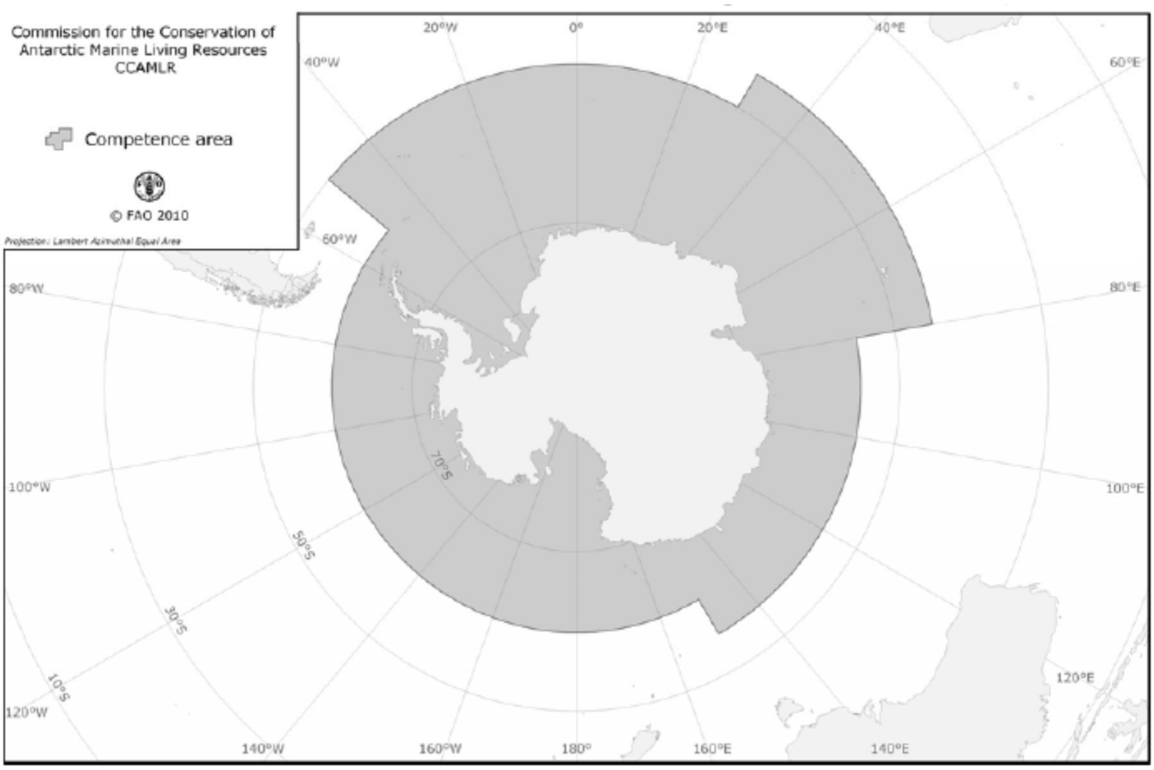

Figure 1 Map of CCAMLR Area. Source: *FAO Fisheries Circular 1054*

Science within the CCAMLR

CCAMLR is considered a best-practice exemplar of an RFMO, the text is considered to contain the clearest conservation aims and is widely considered to be the high-water mark of science-based management.[505] Lodge *et al* in a report on RFMO best practice found that CCAMLR exemplified best practice in many areas including on the quality and effectiveness of science.[506] In another study, focused on the incorporation of the ecosystem and a precautionary approach to management, CCAMLR was identified as the best performing of thirteen RFMOs examined.[507] In 2008 CCAMLR undertook a performance review conducted by a panel of international experts.[508]

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505 Lugten, G. *The Role of International Fishery Organizations and Other Bodies in the Conservation and Management of Living Aquatic Resources*, 2010, The Food and Agricultural Organization, FAO Fisheries and Aquaculture Circular 1054 ('*FAO Fisheries and Aquaculture Circular 1054*'), 82-84.
506 Lodge et al, above n 9, 135.
507 M. Mooney-Seus and A. Rosenberg, 'Regional Fisheries Managment Organizations (RFMOs): Prgoress in Adopting Precautionary Approach and Ecosystem-Based Management' (Fort Hill Associates, 2007), viii.
508 J. Berguno et al, 'CCAMLR Performance Review Panel Report' (2008) <http://www.ccamlr.org/pu/E/e-Prfrm%20Review%20Report%20Jun09.pdf>.

The performance review found that generally CCAMLR and the underlying convention text had well incorporated scientific principles such as the ecosystem approach and the precautionary principle, and that the convention allowed for effective science based management.[509]

The Convention text itself has as its purpose 'the conservation of marine living resources', but conservation is defined so as to also include the "rational use" of those resources.[510] In context it appears that rational use is synonymous with sustainable use and scientific management is required if there is to be any use of living resources aside from conservation. Article II(3) elaborates the objective of fisheries management and notes that any harvesting must have the objectives of: preventing the decline of harvested populations to levels below those which allow stable recruitment, the maintenance of ecological relations between harvested and related populations, the restoration of depleted populations and the prevention of changes to the marine ecosystem that are not reversible over two to three decades.

Article II (3) (a) states that population sizes must not be allowed to decrease below a size that allows stable recruitment or below a size that ensures the greatest net annual increment.[511] This clearly means that MSY is the basis for setting any limits on the population and catch. Fortunately, this Article incorporates MSY not as the aim for fisheries quotas, but as a limit beyond which harvesting is not permitted. The use of MSY as a limit, rather than a goal, is safer practice and is less likely to lead to overfishing either due to uncertainty as to the level of MSY (given ecosystem and environmental factors) or uncertainty as to the actual total catch.

As discussed in previous chapters it is important that science is not called on to make political decisions as this is not what science is designed to do. In the CCAMLR treaty text political agreement has been reached that sets out in detail what managers are required to achieve (a political

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509 Ibid, xii-xvii.
510 *CAMLR Convention*, Art II.
511 *CAMLR Convention*, Art II 3a.

decision) and gives objectives that can be equated to measurable goals. It is for the scientists to provide advice on how these goals can best be achieved. Interestingly, Article II (3) (b) incorporates the ecosystem approach to fisheries management and Article II (3) (c) incorporates the use of the precautionary approach, into the requirements for managers.

In terms of the ecosystem approach, while the CCAMLR performance review found that it was generally well integrated into the organisation, it did point out some potential weaknesses including: the extent of habitat protection, the lack of recovery plans for species already depleted and the lack of penalties for non-compliance.[512] These issues are clearly relevant for the protection of the ecosystem managed by CCAMLR; however, it is unlikely that they could be effectively addressed only in the treaty text. In any event these matters do not go to the integration of science within the Convention itself but rather to how the ecosystem approach is implemented and it appears that the current text would allow for all these measures. One issue raised in the performance review of note is the requirement for RFMOs (CCAMLR in particular) to consider ecosystems as a whole, even where that ecosystem stretches outside the boundary of the RFMOs management authority (for example into areas of national jurisdiction).[513] In the case of CCAMLR there are several areas of national jurisdiction within the Convention area and several parts of the ecosystem that extend beyond the Convention area. In these circumstances there is a need for arrangements to be put into place which allow for compatibility of research and the sharing of information across the ecosystem and where possible for the introduction of compatible management measures. These arrangements are not in place for CCAMLR, however one potential solution to this problem is to include a requirement for States to collect statistics within, and to implement consistent management measures for, areas of national jurisdiction within or adjacent to the CCAMLR area.[514]

[512] Berguno et al, above n 508, 34.
[513] Ibid.
[514] Ibid.

In terms of the precautionary approach to management, the CCAMLR performance review concluded that CCAMLR has properly implemented the precautionary approach and recognised that CCAMLR is considered a world leader in this regard.[515] In support of this claim it cited the establishment of precautionary catch limits, the explicit consideration of uncertainty in stock assessment and a precautionary approach to new and exploratory fisheries.[516] Nevertheless the review did note that CCAMLR had no explicit management processes for dealing with the effects of adverse environmental change. This included a lack of pre-agreed catch limit management options in the face of adverse change, such as unfavourable environmental conditions, a failure of food stocks for a species, or some other non-fishing induced drop in stock number.[517] While this is clearly a weakness with the management regime, it certainly does not seem to have its basis in the text of the Convention itself. The text clearly states in Article II 3(c) that harvesting must aim for the "prevention of changes or minimisation of the risk of changes in the marine ecosystem which are not potentially reversible over two or three decades, taking into account… the effects of environmental changes."

The objectives within Article II are incorporated into the management requirements of the Commission. In order to do this the Commission is empowered in Article IX to: set regional catch limits, declare protected species, declare temporal closures, declare scientific areas, regulate fishing methods, and, to implement any other management measures for the purposes of the Convention.[518] The Commission also has a number of responsibilities that directly assist science. Thus it is to: facilitate research into Antarctic marine living organisms, compile data on the status of, and changes in, population of Antarctic marine living resources and on factors affecting the distribution, abundance and productivity of harvested species and dependent or related species or

[515] Ibid, 51.
[516] Ibid, 50.
[517] Ibid, 51.
[518] *CAMLR Convention*, Art IX(2).

populations, acquire catch and effort statistics on harvested populations and analyse the effectiveness of conservation measures.[519] These roles all further support the idea that rational use is use founded on science.

The CCAMLR text is clearly drafted with management based on science in mind; it envisages a system where science is the primary determiner of management measures. This is exemplified by Article IX which states that the functions of the Commission includes the: facilitation of research and comprehensive studies into marine living resources and the formulation of conservation measures on the basis of the best scientific evidence available, all of which should be formulated to ensure there is no conflict with the obligations of parities under the Antarctic Treaty.

This text is drafted for the best-practice use of science; it incorporates the ecosystem approach, the precautionary approach to management and the use of MSY as a limit rather than goal.[520] These inclusions, along with the unique location of the southern ocean, away from many of the political and human factors that plague other RFMOs, mean that CCAMLR is indeed a high-water mark for the incorporation of science into a treaty text.

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[519] *CAMLR Convention*, Art IX.

[520] For an evaluation of how CCAMLR incorporates the ecosystem and precautionary approach see Mooney-Seus and Rosenberg, above n 507, 12-18.

The South Pacific Regional Fisheries Management Organisation

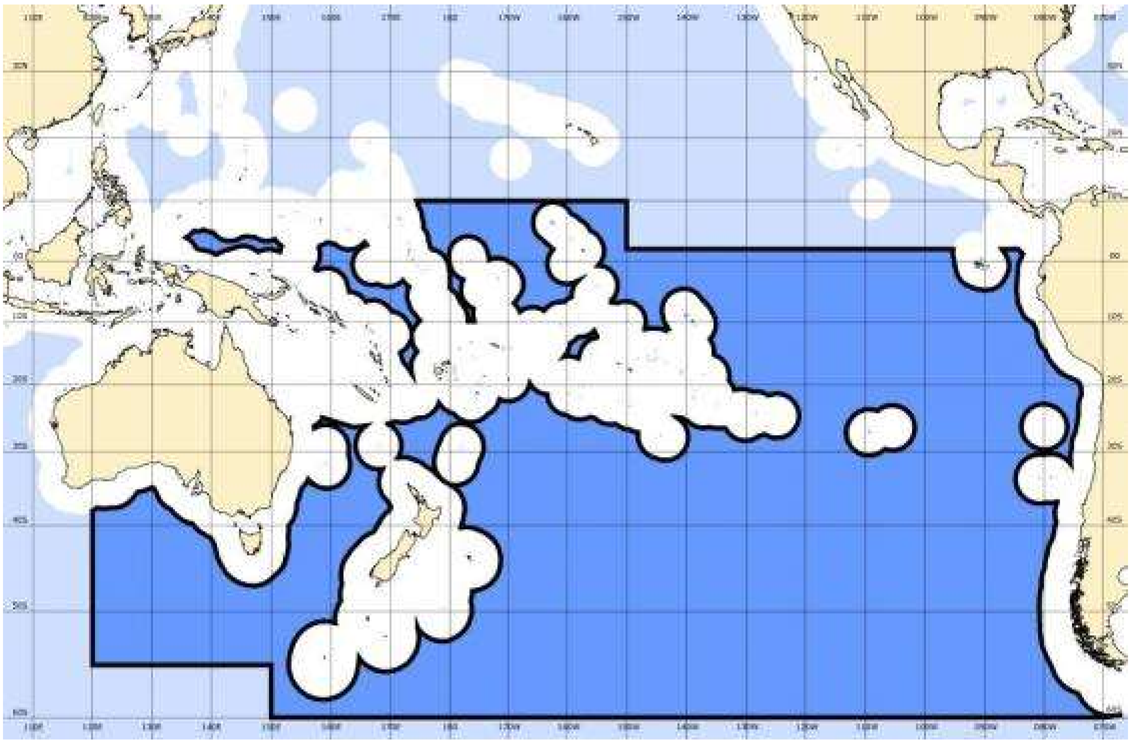

Figure 2 Illustration of SPRFMO Area, Source: http://www.southpacificrfmo.org/illustrative-map-of-sprfmo-area/

In 2006 Chile, Australia and New Zealand initiated talks to create a new RFMO to cover non-highly migratory species in the south pacific. This region will pose a challenge for fisheries management because as can be seen from figure 2, the area takes in both a huge geographic area, and a wide variety in terms of climatic and ecosystem conditions ranging from near polar oceans to tropical seas.

The path to the South Pacific Regional Fisheries Management Organisation Convention (SPRFMO Convention) took many years, with the final convention text opening for signature on 1 February 2010, and then entering into force on 24 August 2012.[521] The first Commission Meeting of the South Pacific Regional Fisheries Management Organisation (SPRFMO) was held in

[521] *Convention on the Conservation and Management of High Seas Fishery Resources in the South Pacific Ocean* adopted 14 November 2008, UNTS I- 50553 (entered into force 24 August 2012) ('*SPRFMO Convention*').

Auckland, New Zealand in early 2013. As a new RFMO it has had the ability to incorporate recent scientific thinking and the lessons learnt from earlier RFMOs into its foundation documents.

Science within the SPRFMO Convention

The SPRFMO Convention itself is more detailed than many other RFMO documents, including detailed Articles for the functioning of the various committees and for the enforcement of management measures. Additionally, the Convention contains annexures that provide specific instruction for the review of the Convention document and on the setting of TACs. As may be expected for a more modern instrument, the level of detail in this text is greater than that in the *CAMLR Convention*, and this is likely to be because the SPRFMO Convention is reflective of the lessons learnt from other RFMOs. Alternatively it may also reflect the political reality that the southern Pacific Ocean is a much more congested space in terms of marine resource exploitation and does not have the same history of conservation cooperation as the Antarctic.[522]

Article 2 of the SPRFMO Convention sets out its objectives 'as ensuring the long-term conservation and sustainable use of fisheries resources and the safeguarding of the marine ecosystem, through the use of precautionary and ecosystem approaches to management'.[523] It is important that a political and legal document clearly sets out the aims of management and SPRFMO aims for long-term conservation and sustainable use. However, it has been seen that science is a very fluid discipline and fisheries science in particular is constantly changing. For this reason it is important that legal instruments are able to adapt to that change. The inclusion of the ecosystem approach as an objective (as opposed to the 'protection of the ecosystem' which is a goal rather than a scientific or management approach), might be current best scientific practice, but it runs the risk of being outdated (and even become a hindrance) should the science change

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[522] The reasons for the comprehensiveness of the treaty cited here are speculative, however it is interesting to note even the earliest drafts of the treaty text were this comprehensive indicating the importance attached to having an effective treaty by the sponsors Australia, Chile and New Zealand.
[523] *SPRFMO Convention*, Art 2.

faster than the legal instrument. The inclusion of the precautionary approach is not the same problem, as the precautionary approach is not a scientific norm, but rather a management approach for dealing with a lack of science.

Article 3 of the Convention further elaborates the objectives and provides even greater guidance as to the aim of management. The Article provides a greater measurability to the objectives while still allowing the flexibility to use best practice science and management even as this changes. This is epitomised in Article 3(1)(a)(i) which states that management in SPRFMO shall "be conducted in a transparent, accountable and inclusive manner, taking into account best international practice." This is further supported by 3(1)(a)(v) which states that: "decisions shall be based on the best scientific and technical information and the advice of all relevant subsidiary bodies". This not only encompasses the use of the ever shifting 'best scientific information' but also incorporates information from other relevant bodies, clearly allowing for the use of non-scientific information in making decisions.

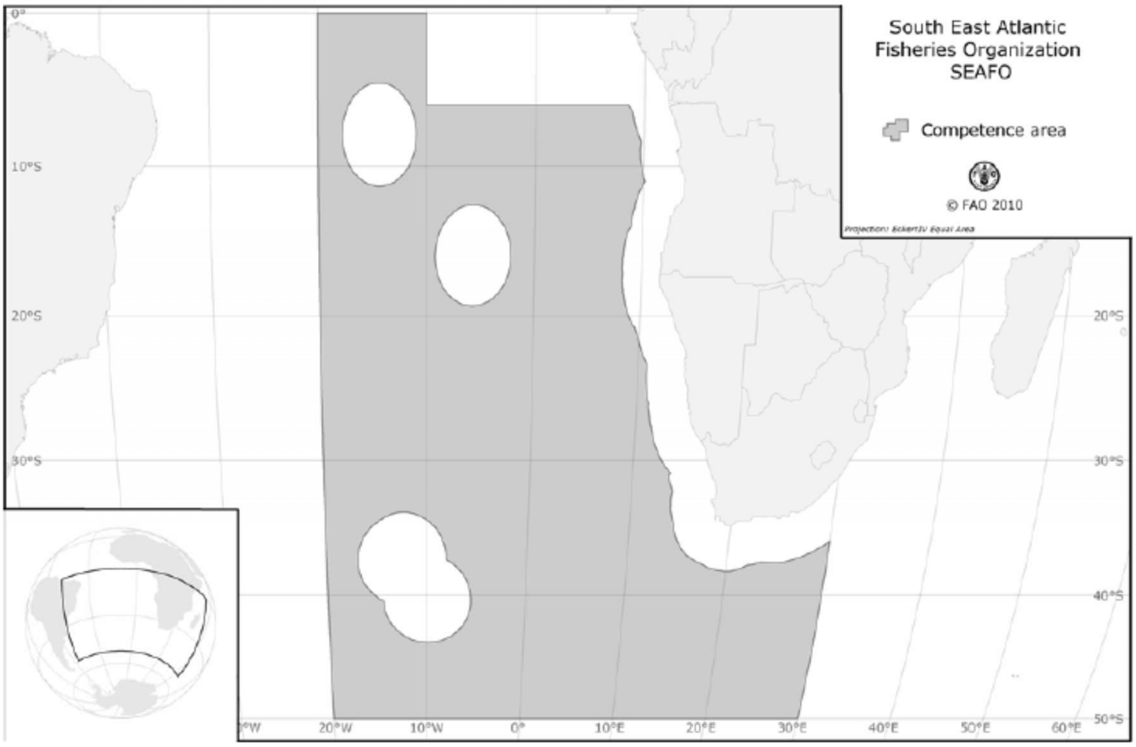
Article 3(1)(a)(ii) clarifies the goal of ecosystem protection (rather than the ecosystem approach to management) by requiring that fishing be commensurate with sustainable use, including the 'impact on non-target and associated or dependent species and the general obligation to protect the marine environment'. This is supported by 3(1)(a)(vii) which provides directly for the protection of marine ecosystems. Interestingly, Article 20 (1)(c) on the adoption of conservation measures adopts slightly different wording where it states that measures should be implemented to ensure the long term sustainability and responsible utilisation of resources. To maintain or restore populations to levels at which their reproduction is not seriously threatened. This limit is significantly more precautionary than limits based on MSY. The terminology included within the SPRFMO convention text, in particular within Article 20, provides clear and measurable guidance for managers and a clear reference point for scientists to base advice on.

Article 3(2) provides for the use of the precautionary approach and states that the approach will be applied as described in *the FAO Code of Conduct* and the 1995 Implementation Agreement. The Article requires managers to "be more cautious when information is uncertain, unreliable or inadequate and not to use the lack of science as reason to delay taking conservation measures."

As a new instrument, the *SPRFMO Convention* has incorporated much of the latest scientific knowledge into its text. The text includes specific objectives, it explicitly refers to and describes the ecosystem approach and the precautionary approach, Article 20 includes the use of precautionary reference points, rather than MSY and the Convention requires decisions to be made on the best scientific evidence available. Interestingly, although the Convention text does not include reference to MSY, fishing mortality and biomass variants of MSY are the primary reference points used in the scientific advice provided to the Commission. While there are hints to it, the Convention text does not specifically incorporate other sources of knowledge or influence into the decision making process, for example economic or social factors, (apart from references to the needs of developing nations,) are not specifically mentioned. Additionally, there is not an explicit mechanism for the Convention text to accommodate radically or even evolutionary changes in science.

The South East Atlantic Fisheries Organisation

Map 11
South East Atlantic Fisheries Organization (SEAFO)



Source: FAO.

Figure 3 Map of SEAFO Area. Source: *FAO Fisheries Circular 1054*

The South East Atlantic Fisheries Organisation (SEAFO) had its genesis in 1995 when the Government of Namibia commenced meetings (over the period of 1995 -1997) with Angola, South Africa and United Kingdom (on behalf of St. Helena and its dependencies of Tristan da Cunha and Ascension Islands).[524] Following these meetings international consultations on the text of the Convention were held in the years from 1997 to 2001 when the *Convention on the Conservation and Management of Fisheries Resources in the South East Atlantic Ocean* (SEAFO Convention) was open

[524] South East Atlantic Fisheries Organisation, *SEAFO Introduction* <http://www.seafo.org/>.

to signature.[525] The Convention was signed on 20 April 2001 and entered into force on 13 April 2003, it currently has four members; the EU, Namibia, Norway and Angola.[526]

SEAFO is responsible for a large area of the high seas from the edge of the West African Coastal State's EEZs to more than half way across the Atlantic as can be seen in figure 3 above. The organisation has management of a range of commercially important species including, both discrete and straddling species, specifically alfonsino, Orange Roughy, Oreo Dories, Armourhead, sharks, deep water Hake and red crab.[527] Deep water and sedentary species are particularly important within the fisheries managed by SEAFO; this gives a special impetus to both habitat protection (vital for fish that live near the sea floor) and long-term sustainability (vital for the many deep water species that are also long-lived).

Science in the SEAFO Convention

The preamble to the SEAFO Convention includes reference to its aim where it states that the contracting parties are committed to ensuring the long-term conservation and sustainable use of all living marine resources and are also committed to safeguarding the environment and ecosystems in which those resources occur.[528] This objective is reiterated in Article 2 of the SEAFO Convention which states it as ensuring the "long-term conservation and sustainable use of the fisheries resources in the Convention area".[529] This wording of the objectives, whilst allowing flexibility for decision makers, does not provide guidance as to what "conservation" or "sustainable use" mean and therefore does not necessarily provide measurable goals for scientists.

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525 *Convention on the Conservation and Management of Fisheries Resources in the South East Atlantic Ocean* adopted 20 April 2001, 2221 UNTS 189 (entered into force 13 April 2003) ('*SEAFO Convention*').
526 The Food and Agriculture Organization, *Regional Fishery Bodies Summary Descriptions: Southeast Atlantic Fisheries Organization (SEAFO)* <http://www.fao.org/fishery/rfb/seafo/en#Org-OrgsInvolved>.
527 South East Atlantic Fisheries Organisation, above n 524.
528 *SEAFO Convention*, preamble para 1.
529 *SEAFO Convention*, Art 2.

Article 3 of the SEAFO Convention provides greater detail as to how the objective shall be implemented. Article 3 (a) contains a requirement that any measures be based on the best scientific evidence available.[530] Subsections (c), (d), (e) and (f) incorporate ecosystem protection measures into the Convention requiring that decisions take into account the impact of fishing on ecologically related species, allowing conservation measures to be made for non-target species associated with targeted species, requiring that measures take into account the need to minimise harmful impacts on all living marine resources and the requirement to protect biodiversity.[531] Article 6 (6) supports both the reliance on science and the ecosystem approach to management, by requiring that the Commission (the decision making body created by the SEAFO convention) "take full account of the recommendations and advice from the Scientific and Compliance Committees, in formulating its decisions, [and], in particular take full account of the biological unity and other biological characteristics of stocks.[532] The implementation of an ecosystem approach is supported by Article 13 on contracting party obligations as it requires, *inter alia*, that each Coastal State provide data relating to straddling or migratory stocks occurring in waters under their jurisdiction[533] and each Coastal State to inform SEAFO of management measures they have taken in waters within their national jurisdiction.[534] This requirement aims to allow fish stocks and ecosystems to be managed holistically, an important part of the ecosystem approach. This effort is further supported by Article 19 which requires contracting parties to cooperate to ensure that management measures are compatible across coastal and convention waters.[535]

Article 3 (b) requires that the precautionary approach is applied in making decisions within the SEAFO convention.[536] This is supported by Article 6 (g) which requires the Commission that is

530 *SEAFO Convention*, Art 3 (a).
531 *SEAFO Convention*, Art 3 (c)-(f).
532 *SEAFO Convention*, Art 6 (6).
533 *SEAFO Convention*, Art 13 (2).
534 *SEAFO Convention*, Art 13 (7).
535 *SEAFO Convention*, Art 19 (1)-(2).
536 *SEAFO Convention*, Art 3 (b).

created by the Convention to apply the precautionary approach.[537] Article 7 details the precautionary approach applied to SEAFO decision making which is based on the requirements of the *UNFSA* and *the FAO Code of Conduct*.[538] The approach is defined in Article 7(2) which states that the "Commission shall be more cautious when information is uncertain, unreliable, or inadequate." Additionally "that the absence of adequate scientific information shall not be used as a reason for postponing or failing to take conservation measures." [539] Interestingly, the Convention also includes a provision requiring that the precautionary approach be implemented in accordance with international best practice, which is an important inclusion to ensure that decision makers can operate with continuously changing standards.[540]

The SEAFO undertook a performance review in 2009 only 5 years after the organisation began in 2004. The review found that the scientific committee had (in part due to a lack of data) failed to provide information that was able to form the basis of a TAC. The panel found the scientific committee had to urgently come up with methods of assessing fish stocks. Fortunately, the panel found that the Commission itself has been able to adopt precautionary approaches including stock closures and closures to trawling.

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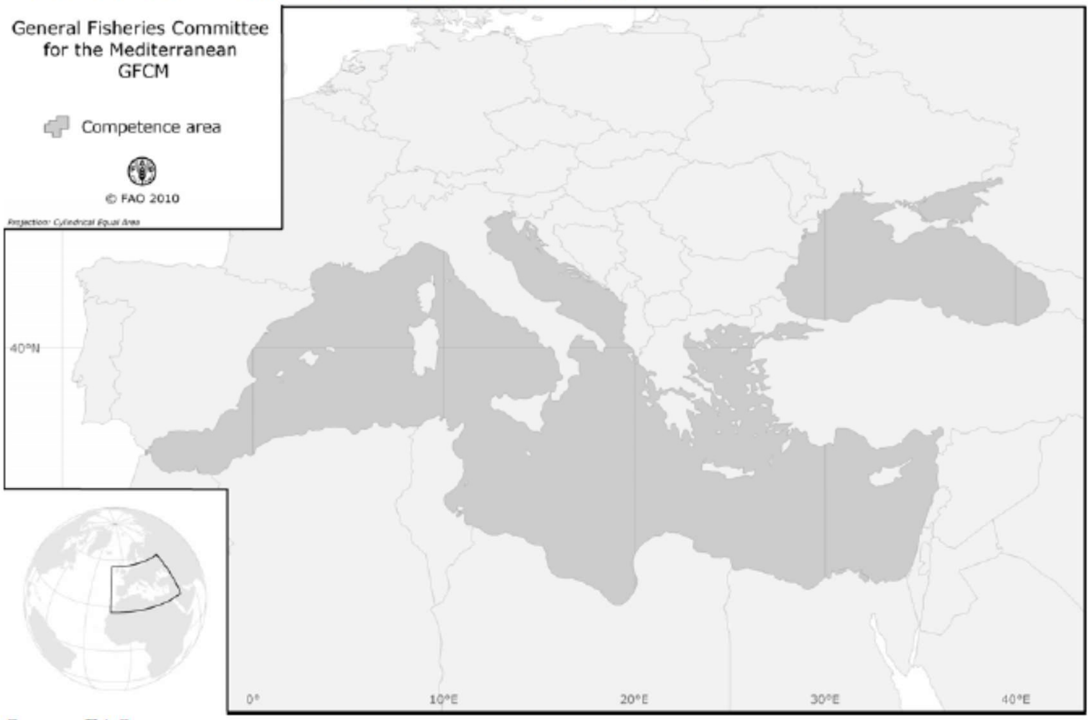
537 *SEAFO Convention*, Art 6(1)(g).
538 *SEAFO Convention*, preamble para 5.
539 *SEAFO Convention*, Art 7(2).
540 *SEAFO Convention*, Art 7(3).

The General Fisheries Commission for the Mediterranean

Map 6
General Fisheries Commission for the Mediterranean (GFCM)



Source: FAO.

Figure 4 Map of GFCM Area Source: *FAO Fisheries Circular 1054*

The General Fisheries Commission for the Mediterranean (GFCM) is one of the earliest RFMOs.

The original agreement was concluded in accordance with Article XIV of the FAO Constitution in 1949.[541] Updates to the agreement have been made in 1963[542], 1976[543], 1997[544] and 2004[545] with the latest amendments being agreed in April 2014.[546] It should be noted that the decision making undertaken by GFCM that has been analysed for this thesis occurred in accordance with the legal framework as it stood between 2004 and 2014 and therefore the framework described below is largely that which was in place from 2004 and the analysis is not a reflection on the current legal framework. The reasons that the 2004-2014 legal framework was selected are that it first provides a greater number of years of decision making to support the analysis in later chapters. Secondly that the 2004 agreement provides a greater variation to the other legal frameworks than the post-2014 agreement, making it more useful for a comparative analysis.

The GFCM has management responsibility for the Mediterranean and Black seas and connecting waters as shown in figure 4 above. Membership of the GFCM is open to both Mediterranean and Black Sea Coastal States and regional economic organisations as well as to United Nations (UN) Member States whose vessels engage in fishing in Mediterranean waters.[547] There are 20 members who have accepted the agreement as amended in 1997 these are: Albania, Algeria, Bulgaria, Croatia,

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541 General Fisheries Commission for the Mediterranean, *About GFCM* <http://www.gfcm.org/gfcm/about/en>; *Agreement for the Establishment of the General Fisheries Commission for the Mediterranean* adopted November 1949, 126 UNTS I-1619 (entered into force 20 February 1952) (with amendments to 1997) (‘*GFCM Agreement*’).
542 Amendment included Adoption of a revised text of the *GFCM Agreement* to implement FAO Conference Resolutions No. 43/57 and 46/57 relating to principles for the granting of observer status and governing conventions and agreements concluded under Article XIV of the FAO Conference - J. Swan, P. Ferlin and J. Maguire, 'Performance Review of the General Fisheries Commission for the Mediterranean and Black Sea' (General Fisheries Commission for the Mediterranean, 2011) <http://151.1.154.86/GfcmWebSite/TaskForce/2013/GFCM_PerformanceReview_2011.pdf>.
543 The Council, in accordance with the provisions of the newly created Article V relating to recommendations on management measures, had the function, inter alia, to adopt recommendations in relation to its responsibilities with regard to the conservation and the management of resources, as listed in Article III (b) (i); and the implementation of conservation and management measures, as specified in Article III (b) (ii) - ibid.
544 These amendments changed GFCM from a Council to a Commission, provided for membership of regional economic integrations organizations and new obligations for the Contracting Parties including their contributions to an autonomous budget for the functioning of the Commission - ibid.
545 General Fisheries Commission for the Mediterranean, above n, 541.
546 General Fisheries Council for the Mediterranean, *Legal Framework*, <http://www.fao.org/gfcm/background/legal-framework/en/>.
547 General Fisheries Commission for the Mediterranean, above n, 541.

Cyprus, European Community, France, Greece, Italy, Japan, Lebanon, Libya, Malta, Monaco, Morocco, Romania, Slovenia, Spain, Tunisia, and Turkey. [548] It is noted that there are 24 members to the current arrangement including the EU.[549]

GFMC has responsibility for all living species within the Agreement Area, which includes a large variety and number of fish stocks, many of which have been heavily exploited over a long period of history.[550] Given the age of the agreement it is to be expected that the GFCM agreement would not have incorporated all current best-practice. Indeed, the GFCM performance review panel found as much in 2011 when they stated:[551]

> The [GFCM] Agreement is weak and outdated and there are many fundamental areas that need improvement, although *de facto* implementation of several areas where there are gaps and weaknesses is occurring. The [GFCM] Agreement should be reviewed and either amended or replaced to ensure an effective legal basis (*emphasis added*).

This performance review was the beginning of the process that cumulated in the updated agreement of 2014.

Science in the GFCM Agreement (as at 2004)

The scientific principles contained within the GFCM agreement begin with Article III on the functions of the Commission which are, inter alia, to promote: development, conservation, rational management and best utilisation of living marine resources.[552] This Article in itself fails to provide clear political guidance as to the aim of management, however, it does provide for rational management which would include management based on scientific evidence. The 2011 performance review identified that this aim may not be suitable for a resource that has been as

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548 General Fisheries Commission for the Mediterranean, *Status of Acceptance of the GFCM Agreement* <ftp://ftp.fao.org/FI/DOCUMENT/gfcm/web/GFCMStatusacceptance.pdf>.
549 General Fisheries Council for the Mediterranean, *About GFCM*, <http://www.fao.org/gfcm/background/about/en/>.
550 General Fisheries Commission for the Mediterranean, above n 541.
551 Swan, Ferlin and Maguire, above n 542.
552 *GFCM Agreement* (as amended until 1997), Art III.

heavily exploited as that managed by the GFCM and recommended that the aim of the Agreement be modified to "long-term sustainable use" or "conservation" rather than utilisation and development.[553] The objective was modified in Article 2 of the 2014 Agreement to be the conservation and sustainable use of living marine resources (similar wording to that found in the CCAMLR agreement) at the biological, social, economic and environmental level.

Article III in the 2004 Agreement, which while not providing a clear objective of scientific management does have further details which appear to support the idea that management should be based on science. Specifically, subsection (1a) requires the Commission to keep under review the state of living marine resources, and (1b) requires the Commission to formulate and recommend conservation and management measures.[554] This is further supported in Article III (2), which states that in formulating measures the Commission 'shall take into account the best scientific evidence available'. While clearly allowing for and encouraging the use of science, these provisions still fail to articulate a clear goal for the fishery. The 2011 performance review recommended the inclusion of an additional function for the Commission to advise on:

> the sustainable utilisation, management, protection and restoration of fisheries and aquaculture resources in the Region based on the best scientific advice and the application of an ecosystem approach, the precautionary approach and the need to safeguard biodiversity.[555]

While it is important to provide for the use of science it is also important that other forms of knowledge have a role in decision making, if they do not there influence will become hidden within scientific advice. The GFCM agreement does well in encouraging this, firstly in Article III (1c) the agreement states that a function of the Commission is to 'keep under review the economic and social aspects of the fishing industry'.[556] Additionally Article III (2) requires the Commission to take into account the need to promote the development and proper utilisation of the resources in

[553] Swan, Ferlin and Maguire, above n 542, 34.
[554] *GFCM Agreement* (as amended until 1997), Art III (1a) – (1b).
[555] Swan, Ferlin and Maguire, above n 542, 35.
[556] *GFCM Agreement* (as amended until 1997), Art III(1b).

addition to the best scientific evidence available.[557] This is continued in Article 5 of the 2014 agreement which requires the Commission to formulate appropriate measured based on the best scientific advice available, taking into account relevant environmental, economic and social factors.

Transparency has been shown to improve decision making. In the 2011 performance review no legal basis for transparency was found within the GFCM Agreement.[558] Specifically the review identified that there was a lack of legal basis for and guidance for the participation of observers, particularly from intergovernmental and non-government organisations, although the reports from GFCM indicate such participation was in fact occurring.[559] Transparency was further addressed in the 2014 Agreement where Article 5(g) required the Commission to promote transparency in its decision making processes. Additionally Article 15 of the 2014 Agreement was included to specifically provide for observers.

One differentiating aspect of the legal arrangements for the GFCM is that the scientific committee is not itself established under the GFCM agreement but under the rules of procedure which provide that:

> There shall be established a Scientific Advisory Committee which shall provide scientific, social and economic information, data, or advice relating to the work of the Commission.

In the 2014 agreement the scientific committee is still created by the Commission, rather than by the agreement itself. The Commission has created the Scientific Committee for Fisheries in Annex 1 of the Rules of Procedure as revised in 2014 which as in the 2004 arrangement has responsibility for scientific, social and economic advice. The rules of procedure include (at section 2(c)) as a function of the committee, the responsibly to provide independent scientific and technical advice

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557 *GFCM Agreement* (as amended until 1997), Art III (2).
558 Swan, Ferlin and Maguire, above n 542, 38.
559 Ibid, 38 and 80.

to enable adoption of recommendation concerning the sustainable management of fisheries and ecosystems at the regional and subregional level.

There is no further mention of science within the 2004 agreement and the review recommended revision of the agreement to include the ecosystem and precautionary approach.[560] Despite management initiatives to try and adapt to current scientific norms, the review went on to find that the GFCM Agreement was often: "undefined, outmoded, conflicting, confusing, inappropriate or technically unsound."[561]

Of the several problems identified by the performance review and relating to how the Commission implements science-based management, the primary issue was the implementation of the ecosystem approach as GFCM scientific assessments were based on sub-areas with no evidence to suggest that the defined areas represent either ecosystems or the extent of certain fish populations.[562] The 2014 amendments have addressed this concern, the specific functions of the Commission include the formulation of measures that minimise the impact of fishing activities on living marine resources and their ecosystems (Article 8 (b)(ii)) and the establishment of fisheries restricted areas to protect vulnerable marine ecosystems (Article 8 (b) (iv)).

MSY is defined in Article 1 of the *GFCM Convention* (as amended in 2014), as the highest theoretical yield that can be continuously taken under average environmental conditions without impacting the reproductive process. Assumedly this definition refers only to negative impacts on the reproductive process as MSY requires reducing the biomass of a fish stock so that the seasonal reproductive yield is maximised. Including the reference to reproductive impacts in the definition therefore only serves as a cautionary warning not to exceed the MSY level for it will result in a drop in reproduction. The definition also includes specific reference to average environmental

560 Ibid, ii-iii and 38-39.
561 Ibid, 29.
562 Ibid, iii.

conditions, which could only be reasonably implied in other definitions of MSY. The inclusion of reference to average environmental conditions does not mitigate the problems with the use of MSY as a target point, because there still remains the problem of significant uncertainty surrounding what average environmental conditions are, what time scale they should be measured over and the impact of future environmental conditions on the level of stock required in the present for sustainability. Fortunately, Article 8 (b)(ii) requires the Commission to adopted multiannual management plans applied to relevant subregions based on an 'ecosystem approaches to fisheries' in order to guarantee the maintenance of stocks *above* levels which can produce MSY.. Meaning that the Commission should not use MSY as a target point, but only rather more conservatively as a limit point.

A different review of GFCM performance identified that while the agreement had incorporated the precautionary approach into the text, the Commission had not done "much more than just state its intent to implement the precautionary approach." [563] This was continued in the 2014 agreement with Article 5(c) requiring the Commission to apply the precautionary approach as defined in *the FAO Code of Conduct*.

[563] Mooney-Seus and Rosenberg, above n 507, 38-44.

Northwest Atlantic Fisheries Organisation

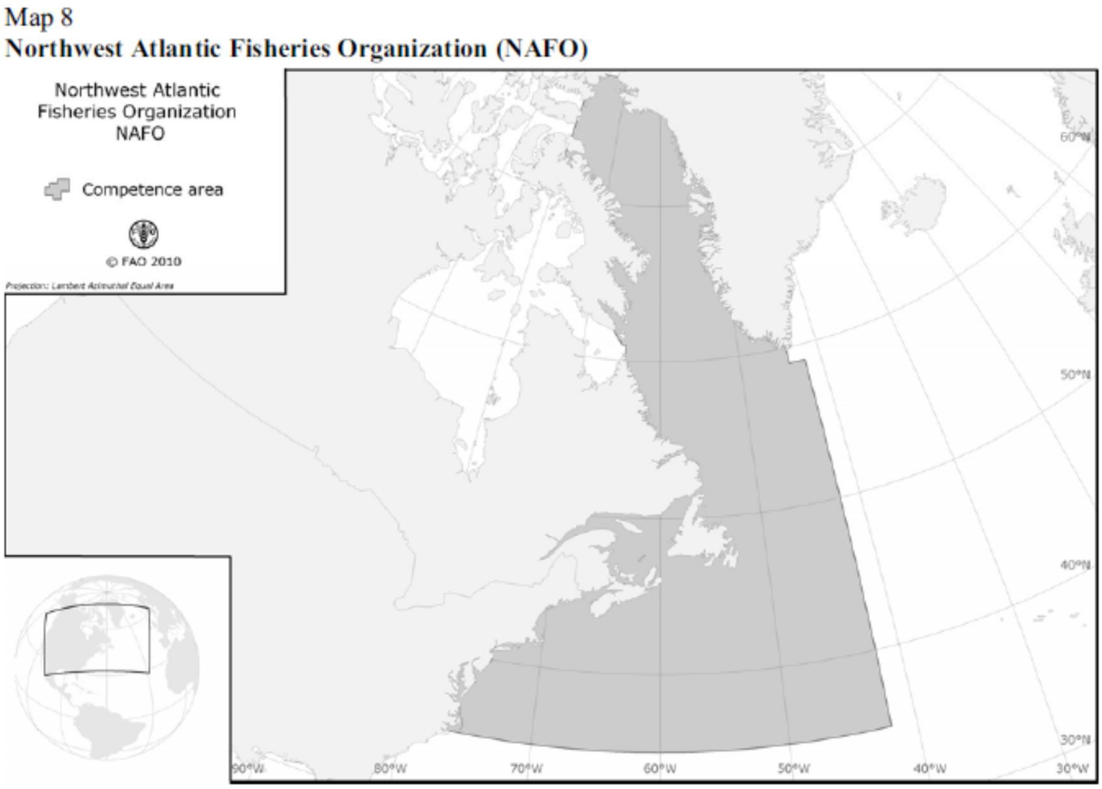

Figure 5 Map of NAFO Area Source: *FAO Fisheries Circular 1054*

The Northwest Atlantic Fisheries Organisation (NAFO) was created by the *Convention on Future Multilateral Cooperation in the Northwest Atlantic Fisheries* 1978.[564] NAFO replaced an earlier organisation, the International Commission of the Northwest Atlantic Fisheries which existed between 1949 and 1978.[565] The Convention Area covers a large proportion of the North Atlantic Ocean as shown in figure 5 above; however, it only has management authority over those areas beyond the EEZs of the Coastal States within that zone.[566] According to NAFO's website nineteen species of fish are targeted commercially within the management area including several species of

[564] Northwest Atlantic Fisheries Organisation, *About NAFO* <http://www.nafo.int/>; *The Convention on Future Multilateral Cooperation in the Northwest Atlantic Fisheries* opened for signature 24 October 1978, 1135 UNTS 369 (entered into force 1 January 2001) ('*NAFO Convention*').
[565] Ibid.
[566] Ibid.

groundfish (Cod, Greenland Halibut, Redfish, and skates) and shrimps.[567] Additionally, a fishing ban (moratorium) is in place for five species: Atlantic Cod, American Plaice, Witch Flounder, Capelin and some types of shrimp.[568] Unlike some of the other RFMOs examined, NAFO does not have management authority over sedentary species, however, given that the target groundfish rely on subsea features (such as the Grand Banks), habitat protection remains important.

The Convention itself was signed on 24 October 1978 and came into effect on 1 January 1979 following the deposit of ratifications of seven signatories. There are currently twelve contracting parties which are:[569]Canada, Cuba, Denmark (in respect of the Faroe Islands and Greenland), European Union, France (Saint Pierre et Miquelon), Iceland, Japan, Korea, Norway, Russian Federation, Ukraine and the United States of America. [570] In 2007 NAFO finalised an amendment (the Amendment to the Convention on Future Multilateral Cooperation in the Northwest Atlantic Fisheries) to the 1978 convention.[571] This amendment has been ratified by five States (Norway, Canada, the European Union, Cuba and the Russian Federation) but needs to be ratified by three quarters of the States parties to the Convention before it will become legally binding.[572] The following analysis of the scientific principles within the text will consider the 1978 Convention and the 2007 amendments separately. As the original Convention was created in 1978, prior to *LOSC* and before much of modern fisheries science, it does not incorporate current scientific best practice into its text, which is an interesting contrast to the amendment document drafted in 2007.

567 Northwest Atlantic Fisheries Organisation, *NAFO Fishery* <http://www.nafo.int/fisheries/frames/fishery.html>.
568 Ibid.
569 Northwest Atlantic Fisheries Organisation, *Contracting Parties to the Convention* <http://www.nafo.int/about/overview/structure/CPs-dates.html>.
570 Northwest Atlantic Fisheries Organisation, above n 567.
571 Ibid.
572 Ibid.

Science in the NAFO Convention

The NAFO scientific principles begin with the preamble to the Convention where the contracting parties state that they desire to 'promote the conservation and optimum utilisation of fisheries resources'.[573] Article II of the NAFO Convention reinforces this and states its objective as being the optimum utilisation, rational management and conservation of the fishery resources within the Convention Area.[574] The NAFO Convention text also provides some indication that science will be at least one of the considerations in the management of fisheries resources by Article II (2) which creates a scientific council and Article VI which sets out the functions of that council including inter alia: to provide scientific advice to Coastal States (when requested) and to provide scientific advice to the Commission (including on its own initiative).[575] There is little further guidance on the role of science as a basis for management, nor on the scientific principles which will guide the management of NAFO. There is no mention of the precautionary approach, the ecosystem approach or a further detailing of the aim of management apart from sustainable utilisation. While a minimal approach in the Convention text does allow for the flexibility that science needs as it continually evolves, the lack of guidance in the NAFO Convention text could currently limit the influence of science on management. Interestingly although the ecosystem approach is not mentioned explicitly, Article XI (3) discusses the requirement for coordination of management measures between Coastal States and NAFO where fish stocks occur both in the Coastal States' waters and in the NAFO Convention Area, a recognition that fisheries need to be managed holistically.[576]

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573 *NAFO Convention.*
574 *NAFO Convention* (with amendments to 1996), Art II.
575 *NAFO Convention* (with amendments to 1996), Art II (2) and Art VI (1) c-d.
576 *NAFO Convention* (with amendments to 1996), Art XI (3).

The 2007 amendments (not yet in force) do provide, as with other modern agreements, an improvement on the incorporation of science into fisheries management.[577] Indeed the preamble to the amended convention sets out an objective of long-term conservation in conjunction with sustainable use and recognises that management should be based on the best scientific advice available and the precautionary approach.[578] Further the preamble explicitly mentions the ecosystem approach and defines it as including: safeguarding the marine environment, conserving marine biodiversity, minimising long term fishing effects and taking into account the relationship between components of the ecosystem.[579]

Article II formally sets out the objective of the 2007 amended convention as being the long-term conservation and sustainable use of fisheries resources and the safeguarding of the marine ecosystem.[580] This adds considerable detail to the earlier convention, particularly by the addition of the "long-term" timeframe for conservation, the addition of a requirement to protect the ecosystem and the replacement of "optimum utilisation" with the more contemporary phrase of "sustainable use". Article III elaborates on how these objectives shall be achieved, stating first that contracting parties shall promote the optimum utilisation and long-term sustainability of fisheries resources.[581] Optimum utilisation is a concept closely related to MSY, essentially being MSY that is modified by economic and social factors to produce the optimal economic yield from the fisheries resource. While the science of optimal utilisation suffers the same way that the science of MSY does, the inclusion of other factors into the equation means that optimum utilisation offers sufficient flexibility to provide for sustainability. Unfortunately Article III (b) undoes much of this flexibility by stating that measures will be adopted "based on the best scientific evidence available"

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577 The 2007 amendments to the *NAFO Convention* require two thirds of the States parties to ratify them before they enter into force.

578 *NAFO Convention* (with amendments to 1996), preable paras 5-7.

579 *Amendment to the Convention on Future Multilateral Cooperation in the Northwest Atlantic Fisheries* adopted 28 September 2007, NAFO GC Doc 07/4 (not yet entered into force) ('*NAFO Amendments*'), preamble para 8.

580 *NAFO Amendments*, Art II.

581 *NAFO Amendments*, Art III (a).

which is good, but it goes on to say that this is to "ensure that fisheries resources are maintained or restored to levels capable of producing maximum sustainable yield".[582] As has been discussed in previous chapters MSY is not a sustainable objective for fisheries management, given the uncertainty that fisheries science faces and the continuous variations within the environment, MSY is almost destined to overestimate the level of a sustainable catch. This reliance on the concept of MSY, so prone to overestimation, seems at odds with the very next paragraph which states that contracting parties shall "apply the precautionary approach in accordance with Article 6 of the 1995 Agreement [*UNFSA*]".[583]

The remainder of Article III formalises incorporation of the ecosystem approach including the requirement to take account of the impact (and minimise that impact) of fishing on other species and marine ecosystems, taking account of the need to protect biological diversity and taking account of the need to minimise pollution, waste, discards and lost or abandoned gear.[584] The ecosystem approach is further incorporated in Article VI on the functions of the Commission itself which requires, *inter alia*, that the Commission seek consistency between conservation and management measures in the Commission's area of management in adjoining areas under the national jurisdiction of a Coastal State and requiring the Coastal State to keep the Commission informed of any management measures that they implement.[585]

The 2007 amendments to the NAFO Convention, provide a step forward in terms of implementing a holistic, ecosystem approach to fisheries management. Unfortunately, in terms of science, even when amended, NAFO will continue to rely on a set scientific measurements, MSY. Not only is MSY a problem from a precautionary perspective in that it invariably overestimates sustainable catches, but it also weds NAFO's scientific advisors to a set way of doing things, leaving

582 *NAFO Amendments*, Art III (b).
583 *NAFO Amendments*, Art III (c).
584 *NAFO Amendments*, Art III (d), (e) and (i).
585 *NAFO Amendments*, Art VI 11(a) - (b).

them no freedom to use the latest scientific tools and methodologies in order to provide the best advice to the Commission.

In 2011 a performance review of NAFO was conducted by a panel of three external and four internal experts.[586] The review considered a range of matters and made recommendations in relation to those issues. In relation to conservation and management, the performance review noted that 11 out of 19 stocks managed by NAFO remain overexploited.[587] Fortunately, the review also noted that the organisation had made significant progress in implementing both the precautionary and ecosystem approaches to management.[588] The performance review also found that science and management decision making were separated at NAFO with the express purpose of ensuring that scientific debate was not contaminated by political considerations. The only concern raised in the performance review about this was that too much separation may lead to communication issues between the two areas.[589] In particular the review found that scientific advice was presented in a scientifically complex manner which assumed a considerable understanding of the scientific methods being applied.[590] In summary the review found that NAFO was doing a good job at fisheries management, but had inherited fish stocks that were not fished sustainably. The review further found that while the science advice being provided was of high quality the legal arrangements could be improved to better implement the ecosystem and precautionary approaches to management and to increase the transparency and communication of the decision making process.[591]

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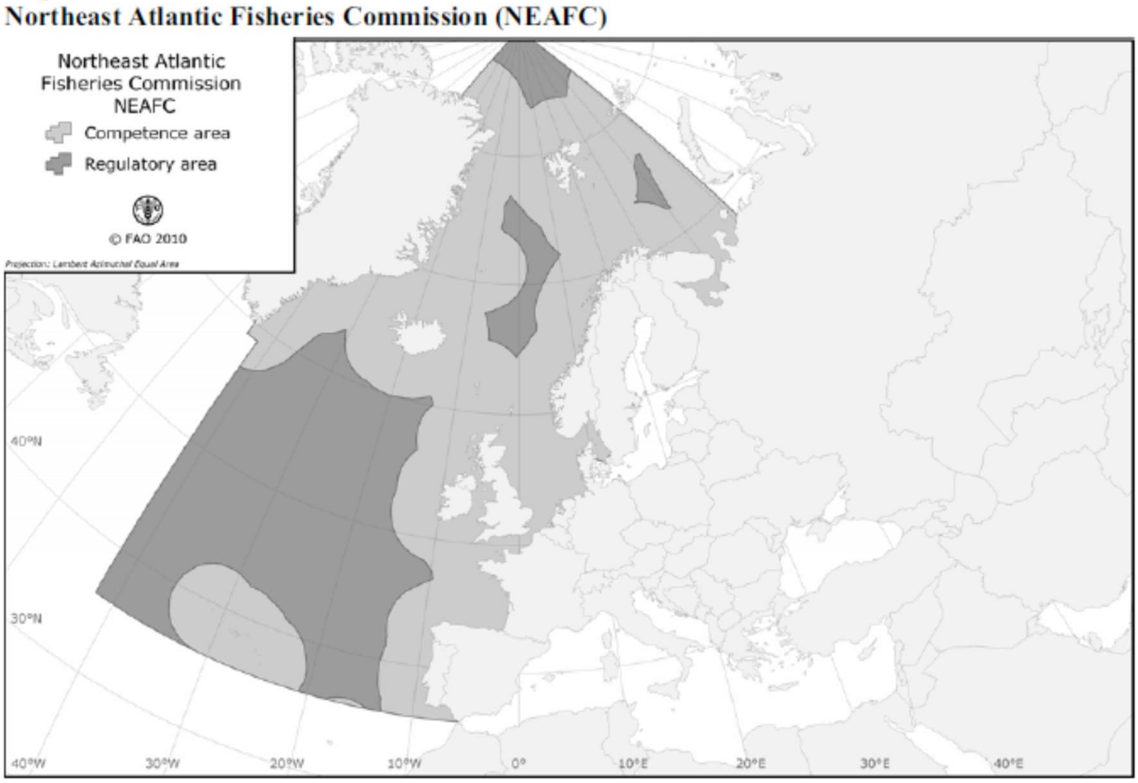
[586] F. Hazin et al, 'NAFO Performance Assessment Review' (Northwest Atlantic Fisheries Organization, 5 August 2011) <https://www.nafo.int/Portals/0/PDFs/Performance/PAR-2011.pdf?ver=2016-09-28-051208-390>.
[587] Ibid.
[588] Ibid, xiii.
[589] Ibid, xiv.
[590] Ibid, xiv.
[591] Ibid, Executive Summary.

North East Atlantic Fisheries Commission



Source: FAO.

Figure 6 Map of NEAFC Area Source: *FAO Fisheries Circular 1054*

NEAFC was created by the *Convention on Future Multilateral Co-operation in the North-East Atlantic Fisheries 1980* (NEAFC Convention).[592] The Convention text has been amended twice by the Commission, in 2004 (not yet entered into force) and 2006 (entered into force on 29 October 2013); these amendments were used from 2006 on a provisional basis by agreement.[593] Given this acceptance and use of the Convention as amended, the legal analysis of the scientific principles incorporated into the text will use the amended convention.

592 *Convention on Future Multilateral Co-Operation in North-East Atlantic Fisheries* opened for signature 18 November 1980, 1285 UNTS 129 (entered into force 17 March 1982) (*NEAFC Convention*).
593 The Food and Agriculture Organization, *Regional Fishery Bodies Summary Descriptions: North East Atlantic Fisheries Commission (NEAFC)* <http://www.fao.org/fishery/rfb/neafc/en>.

NEAFC covers all 'fish, molluscs, crustaceans and sedentary species within its area of competence' except for migratory species covered by other agreements.[594] The NEAFC area of competence is limited to the areas outside of the EEZs of Coastal States in the northeast Atlantic and Arctic Oceans as seen in figure 6.[595] NEAFC currently has five members and 3 cooperating non-parties, the five current members are: Denmark (in respect of the Faroe Islands & Greenland), the European Union, Iceland, Norway, and the Russian Federation.[596]

As the Convention text to be analysed was last amended in 2006 there has been an opportunity to incorporate many recent RFMO practices. Nonetheless, this agreement has a long history, and therefore, there are also some older concepts that persist within the text. Like all area based RFMOs, which have responsibility for sedentary species, the management of the ecosystem and habitat is of vital importance, as is management for the long-term, especially given the slow growth rates of some marine species in deep waters. The NEAFC has also been subject to a performance review in 2006 which analysed both the Convention text and the performance of the RFMO.[597] The review found that NEAFC was an effective organisation with many of its limitations not due to the Convention text or the Commission itself but rather due to the contracting parties.[598]

Scientific Principles in the NEAFC Convention

This discussion will focus on the NEAFC Convention incorporating the amendments to 2006 which make up the 'new convention'. This new convention was applied by the parties on a provisional basis until it entered into force in 2013.[599] When assessing the 2006 Convention

594 Ibid.
595 North-East Atlantic Fisheries Commission, *Map of the NEAFC Regulatory Area* <http://www.neafc.org/managing_fisheries/measures/ra_map>.
596 North-East Atlantic Fisheries Commission, *The structure of NEAFC* <http://www.neafc.org/page/18>
597 K. Arnason et al, 'Performance Review Panel - Report of the North East Atlantic Fisheries Commission, NEAFC.' (North-East Atlantic Fisheries Commission, 2006).
598 Ibid, 57.
599 The *Declaration on the Interpretation and Implementation of the Convention on Future Multilateral Cooperation in North-East Atlantic Fisheries* is available from http://www.dgrm.min-agricultura.pt/xeo/attachfileu.jsp?look_parentBoui=248939&att_display=n&att_download=y.

amendments the performance review panel found that the text incorporated most of the principles espoused in international agreements, in particular the *UNFSA*.[600]

The preamble states the aim of the Convention as being the long-term conservation and optimum utilisation of fishery resources and the safeguarding of the marine ecosystems in which the resources occur.[601] The aim is elaborated in Article 2 which sets out the objectives of the Convention as "ensure[ing] the long-term conservation and optimum utilisation of the fishery resources in the Convention Area, [to provide] sustainable economic, environmental and social benefits." This provides clear guidance to managers while still maintaining the flexibility to use best practice science and management. What the Convention does not do is set minimum environmental or biological standards that equate to 'conservation'. This could lead to disputes on the appropriate balance of economic, social and environmental benefits as called for in the Article. These objectives, when interpreted in light of the Preamble Text, have been found to be consistent with the objectives of the *UNFSA*.[602]

The NEAFC Convention at Article 4 (2) sets out a range of requirements that the Commission is required to consider when making decisions. Article 2(4) (a) requires that any decision of the Commission is based on the "best scientific evidence available'. This terminology, common amongst the RFMOs examined, provides for the use of science while providing flexibility in the type of science used. This is implemented in NEAFC by a partnership with the International Council for the Exploration of the Sea (ICES). ICES is responsible for the provision of scientific advice, including annual stock reviews and specifically requested advice to NEAFC. This relationship is conducted in accordance with a memorandum of understanding - which specifically provides for financial and administrative arrangements.[603] While ICES clearly provides politically

600 Arnason et al, above n 595, 23.
601 *NEAFC Convention* (with amendments until 2006), preamble para 3.
602 Arnason et al, above n 595, 23.
603 Ibid, 25.

independent scientific advice (see Article 1 of the 2003-2006 MOU) which is to be valued, the performance review noted some problems with the arrangement, particularly that ICES meetings were not transparent, and given that the scientific advice was so independent it could be unresponsive and not as focused on management issues as possible.[604] Importantly, the review found that transparency was also a problem in relation to the work of the NEAFC itself, with not enough being done to ensure that NGOs have access to the information that they need to be effective observers.[605]

Article 2(4) (b) requires that the Commission apply the precautionary approach, while no definition is given to the approach, *the FAO Code of Conduct* for Responsible Fisheries and the *UNFSA* are referenced in the preamble so a similar definition of the precautionary approach as espoused in those instruments could be assumed.[606] To implement this, NEAFC, with ICES, have developed precautionary reference points for the primary stocks, however its conservation measures (TACs) have not been based on these reference points and they have been assessed by ICES as not being precautionary.[607]

Although there is no mention of the 'ecosystem approach', Article 2 (4) (c) requires that the Commission take account of the impact of fisheries on other species and marine ecosystems and thereafter to adopt measures to minimise harmful impacts of living marine resources and marine ecosystems. Additionally, Article 2 (4) (d) requires that the Commission take account of the need to conserve marine biological diversity, which itself is defined separately at Article 1 (d) as "*"Marine biological diversity"* meaning the variability among marine living organisms and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems." These two provisions when taken together broadly implement the ecosystem

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604 Ibid, 25-27.
605 Ibid, 48.
606 *NEAFC Convention* (with amendments until 2006), preamble para 2.
607 Mooney-Seus and Rosenberg, above n 507, 133-134.

approach. The ecosystem approach is further operationalised within the Convention by Articles 5 and 6. These Articles provide a framework for NEAFC to make recommendations for conservation measures for areas that are under national (contracting party) jurisdiction. This power is recognition of the need for ecosystems to be managed in a holistic manner.[608] The approach can also be reversed with Article 5 and 6 allowing for Coastal States to adopt measures for the management of a fish stock across its entire geographic range by asking the NEAFC to adopt those measures.[609]

Case Study of A New Agreement – The North Pacific Fisheries Commission

Beginning in 2006 Japan, South Korea, Russia and the United States began formal consultations for a RFMO for the North Pacific Ocean. In 2012 the *Convention on the Conservation and Management of High Seas Fisheries Resources in the North Pacific* (NPFC Convention) was agreed to in Tokyo. The Convention entered into force on 19 July 2015, while there has yet to be sufficient reporting or decision making to allow it to be included in the comparative analysis, it is included as a case study of one of the newest RFMO agreements.[610] It serves as an indicator of current actual practice in the drafting of RFMO agreements.

The objective in Article 2 of the NPFC Convention (like many of the other texts considered), is for the long-term conservation and sustainable use of fisheries resources. Article 3 of the text reproduces much of the same Article in the 2007 amendments to the NAFO convention, further describing the objective of management as the 'optimum utilisation' and the maintenance or restoration of fish stocks that can produce maximum sustainable yield.[611] As with the 2007 amendments to the NAFO convention these seem at odds with later sections within the same text

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608 See Articles 8 and 9 for procedural limitations on the ability to make recommendations, *NEAFC Convention.*
609 Arnason et al, above n 595, 17.
610 Convention on the Conservation and Management of High Seas Fisheries Resources in the North Pacific 24 February 2012 (entered into force 19 July 15) (available http://npfc.r-cms.jp/files/user/docs/Convention%20Text.pdf) (*NPFC Convention*).
611 *NPFC Convention*, Art 3.

which call on management practices to be in accordance with the precautionary approach as reflected in the *UNFSA*. However, Article 3 of the NPFC Convention does contain an incorporation of the ecosystem approach (likewise worded as in the 2007 amendments to the NAFO convention) and implements that approach by providing for consistency between measures taken on the high seas and measures taken by contracting parties in areas under national jurisdiction.[612] Interestingly in terms of decision making Article 7 of the NPFC Convention requires that the Commission ensure "that levels of total allowable catch or total allowable level of fishing effort are in accordance with the advice and recommendations of the scientific committee'.[613] While this would, if followed, seem to ensure that science is the basis of TAC decisions, it risks simply being ignored in the face of political or economic pressures, or, perhaps more dangerously, risks the scientific committee becoming a defacto decision making body and hence encouraging political and economic considerations to be disguised as scientific advice. Unfortunately, as this convention has only recently begun operations it may be sometime before the effect of this Article and the rest of the Convention are able to be examined.

The Features of RFMO Legal Frameworks

This chapter has described and examined the legal framework of a broad range, but not all, RFMOs. The RFMOs considered have been limited to those that are marine capture, multispecies and geographically limited. The aim has been to understand how those legal agreements incorporate science, and to find evidence as to how well those agreements incorporate science. One of those most important areas for RFMO managers and scientist to consider are the objectives of management. Objectives are clearly a political decision, one which the States coming together to form the RFMO must make for themselves. It is not the place of science to determine what the object of management should be? Equally, the objectives of management should also be

612 *NPFC Convention*, Art 3 (c),(d),(e),(i) and (j).
613 *NPFC Convention*, Art 7 (1) (b).

ones which science can advise upon, or in other words, operationalise. Conversely, objectives should not be formulated in a way that makes specific scientific outcomes the goal (such as MSY), as these ideas, (like most science) will fall out of practice and favour with time. Finally, to ensure that science is used to maximum effect, objectives should incorporate the need to manage fish stocks based on rational or scientific reasoning and evidence. In the RFMOs examined there have been a range of different formulations for the objectives of management. Many of the RFMOs examined, including; SPRFMO, SEAFO, NAFO (2007 amendments) and NPFC, have an objective of 'long-term conservation and the sustainable use of fisheries resources'. These same texts also include an objective of 'safeguarding or protecting the marine ecosystem'. CCAMLR has a more definitively conservation purpose stating its goal to be the 'conservation of marine living resources'. GFCM has a more utilitarian objective which is the promotion of, development, conservation, rational management and best utilisation of marine resources, with no mention of the marine environment. Likewise, NAFO (1978 text not including 2007 amendments) has the objective of promoting conservation and optimal utilisation, a term laden with scientific and economic meaning. The NEAFC text also reflects this wording using 'long-term conservation and optimal utilisation of fisheries resources,' however, the text also includes the aim of 'safeguarding the marine ecosystem. All the objectives examined seek political agreement as to the balance of utilisation of living marine resources and conservation of those resources and the environments they live in. All the RFMOs are effective in that they set down that balance in a way that maintains flexibility of action for management. Unfortunately that flexibility also means that in some cases there is room for disagreement as to what the objective means and what standard should be met, and in these cases it will require further political guidance.

An additional problem arises in some convention texts when the objectives are stated in a way that has scientific meaning. For example both NAFO (pre-2007) and NEAFC use the term optimum utilisation to define their goal. Optimal utilisation is MSY modified by economic and social factors. The use of this term gives scientists clear guidance as to what the goal is and the methodology of how to measure it, but it also ties them to using a scientific methodology and approach that many now consider out of date and inappropriate as an objective. This can be compared to the use of MSY language in the *CAMLR Convention* where it is set as a limit. The use of MSY as a limit rather than an objective is currently more accepted by the scientific community. Unfortunately the future may see best practice move on from this too and then the *CAMLR Convention* would be left using a limit that was no longer acceptable. Wording such as the 'precautionary reference points, or limits' could be used as an alternative.

The second issue examined was the inclusion within RFMOs of the current fisheries management best practice principles: the ecosystem approach and the precautionary approach. Many of the RFMO agreements include a goal to protect or safeguard the marine ecosystem, which is recognition of the relationship between the environment and the fish stocks and an important objective. This is a different prospect to incorporation of a requirement for specific types of management such as the ecosystem approach. It is appropriate for political agreement to determine that the aim should be the protection of the ecosystem, and also in relation to powers of implementation, that States and the RFMO should strive to implement consistent conservation across the full area of their combined jurisdiction. It is quite ineffectual for political agreement to dictate that certain types or approaches to science be used, because as science best practice changes such prescriptions have the ability to require RFMOs to use out of date methodologies. This applies even where science appears as conclusive as it does of the benefits on the ecosystem approach to fisheries science and management. The ecosystem approach as a management and scientific approach is also incorporated into the SPRFMO text which states that objectives will be achieved 'through the use of the ecosystem approach'. This is a problem as on some interpretations of the text it could tie the fisheries scientist to the use of a scientific approach (the ecosystem approach to fisheries science) that may not remain best practice into the future. Alternatively on other readings it may simply be a reference to the requirement that managers consider the ecosystem in making decisions. Other RFMOs avoid this problem with CCAMLR, SEAFO, NAFO (2007 amendments) and NEAFC all incorporating requirements for managers (and therefore the scientists who advise them) to consider effects on the ecosystem and related species when making decisions and also requiring States to provide information on fish stocks and conservation measures in areas of national jurisdiction adjacent to the RFMO. This approach is more akin to having an objective of protecting the ecosystem as it does not tie scientists to any one approach but rather asks them to consider particular effects when providing advice, an objective decision rather than a decision on scientific methodology.

The incorporation of the precautionary approach to management does not raise the same problems as the ecosystem approach. The precautionary approach is not a scientific principle, nor is it based on science but rather the opposite, it is a principle for managers to follow when science cannot provide an answer. Shortly stated, the precautionary approach requires managers to favour conservation and the safeguarding of stocks where there is doubt in relation to the science. As such the implementation of the precautionary principle is guidance to managers, not scientists, and does not bind scientists to any particular methodology. The precautionary approach is therefore more akin to an objective and is implemented in all the RFMOs examined, except for the NAFO 1978 Convention (it is included in the 2007 amendments) and the GFCM text (noting that the Commission has implemented aspects of the approach despite the lack of mention in the text). Finally for some RFMOs, issues of transparency have been discussed. Transparency is an important feature of proper decision making in a range of fields of knowledge, not just science or fisheries management. The requirements of transparency and how they are incorporated in to RFMO agreements and practice will be examined more fully in later chapters.

Chapter 5

Comparing the Influence of Scientific Recommendations on Decision Making in Selected Regional Fisheries Management Organisations – Methodology and Results

There is a perception that one of the key problems with RFMOs is the failure of decision makers to follow scientific advice.[614] Supporting this perception with data, a 2007 report compiled by Chatham House found that only three RFMOs consistently made decisions in accordance with scientific recommendations.[615] This is despite the fact that the majority of RFMO agreements contain a legal requirement that decisions be informed by, or based on, scientific advice.[616] This chapter will analyse the correlation between the scientific advice provided to RFMOs and the final decisions made by those RFMOs.

In research by Oh the effect of scientific advice on decision making was analysed in-depth through interviewing participants from one RFMO.[617] Oh interviewed scientists, national representatives and administrative staff in order to ascertain the view held by each on the science used within the RFMO. Her interviews examined the reasons why scientific advice was not followed. The research resulted in a range of important findings, but did not focus on the impact of the relevant legal framework on the relationship between scientific advice and decision making. The comparative analysis in this thesis will focus on this impact.

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[614] McDorman, above n 64, 425.
[615] Lodge et al, above n 9, 134.
[616] McDorman, above n 64, 435.
[617] Oh, above n 299.

Methodology

In this chapter the recommendations and advice from the RFMOs scientific advisory bodies is compared to the decisions and conservation measures adopted by the decision making bodies. To conduct this comparison, reporting from scientific advisory bodies and decision making bodies was obtained from the selected RFMOs. The reports were normally obtained through the RFMO websites, or where they were unavailable, via email correspondence with the RFMO.

The comparison of advice and decisions is not intended to be a critique of any particular RFMO but rather a tool to illuminate the effect that variations between legal frameworks can have on decision making processes. Given this aim it was not imperative to provide a comparison for every year that an RFMO has been active. Therefore, for each RFMO included, a range of years for comparison were selected. The primary purpose behind the selection of year ranges was to ensure that the comparison could be linked to a consistent legal framework. The selected range begins, for most RFMOs, after the most recent amendments to the legal framework began to be applied.

The comparisons are presented first in a summary and then in a table. The table lists the advice provided by the relevant scientific advisory body and the decision taken, year-by-year. The table is formatted so that the information presented in the scientific advice column matches the information presented in the decision made column, provided that both the scientific advisor and the decision maker reported on the matter. Where either the scientific advisory body, or the decision maker didn't report on a matter considered by the other, the corresponding space in the column is blank or specifies that the body did not consider the matter. Additionally, a final column is included which summarises whether the RFMO decision maker followed scientific advice for that year. To aid with clarity a traffic light system is used whereby the summary column is coloured green where the RFMO largely followed scientific advice, orange where they partially or occasionally followed advice, and red where they largely did not follow advice or did not report considering advice. The reasons for any divergence between advice on a stock and the relevant conservation measure has been identified where possible. Unfortunately while all RFMOs made reports of meetings publically available, the detail included within the reports varied considerably, which meant that in many cases a reason for a divergence could not be identified.

The Effectiveness of the Selected Methodology

The intent to focus on the impact of the legal framework is the reason that this thesis utilises a comparison of publically available reports (from a range of RFMOs, rather than a single body), and rather than an interview process. Comparing the different RFMOs allows for a comparison between decision making processes under different legal frameworks, structures, policies and procedures. The use of interviews within a single RFMO (as in Oh's thesis) does not allow this comparison and reports instead the perceptions and insights of participants within the process of the features that affect the relationship.

There are, however, several limitations with the chosen methodology. The first is that the reporting of RFMOs is of varying quality, in many RFMOs the reporting does not include the decision makers' discussions of all scientific recommendations, nor provide the reasons that those recommendations were not followed. Secondly, in all RFMOs there were years where the reporting was poorly structured and limited the comparison between advice and decision. This was particularly the case when reports simply followed the narrative of a meeting, rather than laying out specific decisions. That a report of a reason for any divergence was often missing means that this method primarily identifies correlations between the features of the legal arrangement and the frequency with which scientific advice is, or is not, followed. Given the increasing numbers of RFMOs (which have often had more than one legal arrangement) the identification of these correlations can provide useful evidence of which features of legal arrangements work and which do not. Especially when coupled with an understanding of best practice from the available literature.

It is likely that in the future it will be beneficial to compare the decision making processes of RFMOs before and after amendments to their conventions. For example when the most recent amendments to the NAFO Convention enter into force in 2017 it would be illuminating to compare the decision making processes under the two legal frameworks to determine whether the convention change has any impact. GFCM has also recently amended its convention and a similar before and after comparison would likewise be beneficial.

Comparative Results

The Convention for the Conservation of Antarctic Marine Living Resources

The CCAMLR convention entered into force in 1982 as part of the Antarctic treaty system. The Convention creates both a Commission (the decision making body) and the Scientific Committee. Commission membership (currently 24 members plus the European Union) is based on having ratified or acceded to the Convention, for those States who were not founding members there is also a requirement that they be involved in the research and resource utilisation work of CCAMLR.[618] Members are allowed to participate in and vote as a part of the Commission's decision making process and substantive decisions of the Commission are made on the basis of consensus, with all other decisions being made by simple majority.[619] All members of the Commission are also entitled to be members of the Scientific Committee.[620] The recommendations of the Scientific Committee are normally made by consensus, however, where consensus cannot be achieved the Scientific Committee must forward all views expressed to the Commission for

[618] *CAMLR Convention*, Art VII.
[619] CCAMLR, *Rules of Procedure of the Commission*, originally adopted at CCAMLR-I, (11 June 1982) available at https://www.ccamlr.org/en/document/publications/rules-procedure-commission..
[620] CCAMLR, *Rules of Proceedure for the Scientific Committee*, originally adopted at CCMALR-II (9 September 1983), available at https://www.ccamlr.org/en/document/publications/rules-procedure-scientific-committee, Rule 1.

consideration.[621] The Scientific Committee has its own budget allocated for scientific work and is able to seek the input of independent experts into their work.[622]

The CCAMLR Commission has an excellent record of implementing decisions based on the advice of the Scientific Committee and this is shown both in Table 1 (see for example years 1984, 1987, 1995, 1998, 2011, 2012, 2013, 2014 and 2015) and in the CCAMLR Performance Review.[623] Where a decision on conservation measures was not reached by the Commission, (a rare circumstance), it was in most cases because the Scientific Committee could not reach a consensus on the scientific advice (see for example years 1989, 1990 and 2009 in Table 1). The failure of the Scientific Committee to make a recommendation was not, however, normally an obstacle to the Commission making a decision. In most cases of the Scientific Committee being unable to provide advice the Commission was still able to implement conservation measures. Where the Commission acted in the absence of scientific advice they did so on the basis of the precautionary principle, or continuation of previous measures (see for example 1985, 1991- 1994, 1996-2000, 2002-2009 and 2012-2015, Table 1). The prevalence of occasions where the Commission implemented conservation measures even in the absence of scientific advice and based on political principles such as the precautionary approach highlights the importance of decision making bodies being able to use information other than science. The ability of CCAMLR to make difficult decisions (such as to cut TACs even in the absence of consensus in scientific advice) was enabled, in part, by the explicit requirement for the use of the precautionary approach in Article II of the C*CAMLR Convention* and the use of pre-agreed management measures.[624] An example of this is Conservation Measure 7/V which adopted a requirement for anticipatory conservation measures to be implemented in the event that other measures could not be agreed by consensus. The system of

621 Ibid, Rule III.
622 Ibid, Rule I.
623 Berguno et al, above n 508.
624 Ibid, 44-47.

pre-determined management responses was refined in relation to the krill fishery through the use of the krill yield model and its use allowed for the implementation of conservation measures even in situations of high scientific uncertainty.[625] Additionally, CCAMLR has continually improved the transparency provided by their publically available reports. Earlier reports were not set out clearly and the recommendations from the Scientific Committee to the Commission were not necessarily easy to find. In later years (starting in 2013) the reports of the Scientific Committee have been formatted to clearly highlight the recommendations to the Commission. Further, the Commission itself has increased the level of detail provided on discussions around those recommendations. All of which have greatly increased the transparency of CCAMLR decision making.

Interestingly, even in CCAMLR there were occasions where the quality or independence of the scientific advice provided by the Scientific Committee was questioned by members of the Commission. This was the case in 1986 where, at the Commission, the USSR was concerned that advice provided by the Committee did not include the best data available (which notably did not include data provided by the USSR). The problems in this year could be assumed as political with the USSR blocking some measures even where there was consensus scientific advice provided. Again in 1990 the advice on a number of species was contested by the USSR's representative within the Scientific Committee. On this occasion the Committee reported both points of view to the Commission so that they had full information on which to base its decisions. However, when the proposal for a conservation measure based on the disputed scientific advice came to the Commission it could not be adopted because of a lack of consensus. These years demonstrate the ability of Member States to block measures, or set TACs above scientific advice, for domestic or political reasons. The ability of individual States to block measures is particularly acute where consensus decision making is required and the only alternative is an open fishery. For CCAMLR

[625] A.J. Constable, 'CCAMLR ecosystem monitoring and management: future work' (2002) 9 *CCAMLR Science* 233, 235.

these problems have been resolved at the political level and therefore have not required a change to the legal framework; and from 1990 there have been no further cases of conservation measures being blocked by a single member.[626] Despite the long-history of consensus decision making working within CCAMLR the CCAMLR Performance Review panel identified a requirement for a dispute resolution mechanism to ensure that consensus did not unnecessarily impede the implementation of measures.[627]

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[626] Berguno et al, above n 508, 82.
[627] Ibid, 81-82.

Table 1 - The Commission for the Conservation of Antarctic Marine Living Resources

This table summarises the recommendations of the CCAMLR Scientific Committee compared with the decisions by CCAMLR (the Commission). It is not intended to include every recommendation of the Committee and every act of the Commission, but rather focuses on core management decisions which arguably would benefit from scientific advice and input. Where the Scientific Committee merely notes the currently applicable conservation measures or the findings of previous meetings, the material is not generally included in the Table.

Year	Scientific Advice	Decisions Made	Summary
1982	From the Scientific Committee Report.[628] The Scientific Committee's (the Committee) first meeting found that there was an urgent need for collation and collection of biological and ecological information (Annex 2).	From the Commission Report.[629] The Commission for the Conservation of Antarctic Marine Living Resources (the Commission) received a verbal report of the Scientific Committee's meeting but as both meetings were held concurrently the specific measures were not discussed.	The Commission did not act on the Committee's recommendation at this meeting – likely due to the timing and informality of the Committee's findings.

628 Scientific Committee, 'Report of the First Meeting of the Scientific Committee for the Conservation of Antartic Marine Living Resources ' (CCAMLR, 11 June 1982), 10.

629 J.L. Farrands, 'Report of the First Meeting of the Commission for the Conservation of Antarctic Marine Living Resources.' (CCAMLR, 11 June 1982).

Year	Scientific Advice	Decisions Made	Summary
	The Committee recommended the introduction of a log book for all commercial fishing (Annex 2).		
1983	From the Scientific Committee Report.[630] The second meeting of the Committee discussed the setting up of subsidiary working groups. It made no scientific findings and did not discuss management goals or measures.	From the Commission Report.[631] The Commission welcomed the report of the Committee and looked forward to substantive recommendations.	No substantive measures discussed by the Committee or the Commission.

630 D. Sahrhage, 'Report of the Second Meeting of the Scientific Committee for the Conservation of Antartic Marine Living Resources' (CCAMLR, 8 September 1983).

631 A. Brown, 'Report of the Second Meeting of the Commission for the Conservation of Antarctic Marine Living Resources' (CCAMLR, 9 September 1983).

1984	From the Scientific Committee Report.[632] The Committee could not agree to recommend closing area 48.3 due to reservations (from the USSR and Poland) on the sufficiency of the data (paragraph 7.34 – 7.36). The Committee recommended that the area within 12m of South Georgia be closed to fishing (paragraph 7.28). The Committee noted with approval the implementation of mesh size limitations by some States and agreed that they should continue (paragraph 7.25).	From the Commission Report.[633] Despite the fact that the Committee could not agree to close area 48.3 the Commission requested (non-binding) members to refrain from fishing for *N.rossii* in that area. The Commission further requested States avoid the by catch of *N.rossii* when fishing for other species in that area (conservation measure II/III (1984) and paragraph 38). As recommended by the Committee the Commission formally declared waters 12nm within South Georgia to be closed to all by scientific fishing (Conservation I/III (1984) paragraph 48). The Commission in line with the recommendations of the Committee adopted binding minimum mesh sizes for certain fisheries (paragraph 49).	The Commission accepted and adopted measures recommended by the Scientific Committee. It further adopted some measures that could not be agreed upon in the Scientific Committee.

Year	Scientific Advice	Decisions Made	Summary
	The Committee identified a range of species particularly *N.rossii* within the CCAMLR area that were depleted and in need of conservation measures (paragraph 7.30).	The Commission agreed with the committee that *N.rossii* was depleted and in urgent need of conservation (paragraph 37).	
1985	From the Scientific Committee Report.[634] The Committee confirmed that *N.rossii* was still severely impacted by fishing, both around South Georgia and Kerguelen Island but stated that there was not enough data to assess other areas. The Committee urged the Commission to consider measures to improve the status of the species identified as depleted and recommended that a complete	From the Commission Report.[635] The Commission prohibited directed fishing on *N.rossii* around South Georgia (sub-area 48.3) and required that by-catch of *N.rossii* in fisheries directed to other species shall be kept to the level allowing the optimum recruitment to the stock (Conservation Measure 3/IV). This measure was not the complete closure that the Committee recommended.	The Commission did not adopt measures in accordance with the recommendations of the Committee. In relation so sub-area 48.3 the conservation measures was a prohibition on direct fishing rather than a complete closure and in relation to

[632] D. Sahrhage, 'Report of the Third Meeting of the Scientific Committee for the Conservation of Antartic Marine Living Resources' (CCAMLR, 12 September 1984).
[633] A. Brown, 'Report of the Third Meeting of the Commission for the Conservation of Antarctic Marine Living Resources' (CCAMLR, 14 September 1984).
[634] D. Sahrhage, 'Report of the Fourth Meeting of the Scientific Committee for the Conservation of Antartic Marine Living Resources' (CCAMLR, 9 September 1985), in particular see paras 4.68-4.81.
[635] O. Rebagliati, 'Report of the Fourth Meeting of the Commission for the Conservation of Antarctic Marine Living Resources' (CCAMLR, 13 September 1985).

Year	Scientific Advice	Decisions Made	Summary
	closure of sub-area 48.3 as the only way to ensure no catch was taken (paragraph 4.37 - 4.47 and 4.70). Around Kerguelen (58.5) the Committee could recommended that a prohibition on directed fishing would be sufficient to prevent further decline in *N.rossii* (paragraph 4.74). Despite not being able to agree on the status of fish stocks outside of sub-area 48.3 and 58.5 the recommendations to the Commission included *"To prevent overexploitation it would be desirable to establish measures limiting fisheries activities in such areas until such time as data are sufficient to estimate fishery productivity in these areas"* (paragraph 4.76).	The Commission requested that members refrain from directed fishing for *N.rossii* around Kerguelen (58.5) (Resolution 3/IV). This was not a legally binding conservation measure in accordance with Article IX of the Convention.	sub-area 58.5 there was only a resolution not a (binding) conservation measure. There were some concerns expressed that the Committee's recommendations were not based on rigorous science (paragraph 33 of the Commission Report).

Year	Scientific Advice	Decisions Made	Summary
	The Committee recommended that the Commission take steps to ensure that past catch data was provided to the Committee to allow it to make fisheries assessments.	The Commission (in response to concerns raised in the Committee over the previous 3 years) made mandatory the reporting of certain information and statistics (paragraph 45).	
1986	From the Scientific Committee Report.[636] The Committee provided a range of options to the Commission to protect the depleted *C.gunnari* and *N.gibberifrons*. It set out its recommendation in a list of most effective to least. The first option being a total prohibition on fishing in the area concerned. The second was a prohibition on directed fishing and the third was the setting of a low total allowable catch. It addition it suggested that limits on mesh size should apply (paragraph 4.49).	From the Commission Report.[637] The Commission could not agree on any of the measure to protect depleted *C.gunnari* and *N.gibberifrons*. The Commission report is clear (paragraph 51-52) that as members could not agree, no decision was made. The status quo of current catch levels therefore remained by default.	The Commission could not agree with all the findings made by the Committee. Some members of the Commission were concerned that the recommendations were not based on the best science available (paragraphs 49-57). The Commission implemented all other

[636] D. Sahrhage, 'Report of the Fifth Meeting of the Scientific Committee for the Conservation of Antartic Marine Living Resources' (CCAMLR, 15 September 1986), paras 4.1-5.36.
[637] O. Rebagliati, 'Report of the Fifth Meeting of the Commission for the Conservation of Antarctic Marine Living Resources' (CCAMLR, 19 September 1986).

Year	Scientific Advice	Decisions Made	Summary
	For sub-area 48.3 the Committee recommend that directed fishing prohibition for *N.rossii* should remain in force. The Committee further recommended extending the management measures into two other areas where States had previously only been requested to refrain from fishing (paragraph 4.36-4.53). Around South Georgia the Committee found that *N.rossii*. *C.gunnari* and *N.gibberifrons* were all depleted and it was recommended that there be further measures in statistical area 48 (paragraph 4.45). The Committee recommended that the previously agreed measures (requests to avoid directed fishing) remain in force for sub-area 58.5 (paragraph 4.40).	The Commission agreed with the Committees recommendations and maintained the current prohibitions on fishing for *N.rossii*. The Commission also extended those prohibitions to two further areas (48.1 and 48.2) (conservation measures 5/V (1986 and 6/V (1986) and paragraph 50). The Commission could not reach agreement on implementing protection measures on depleted *C.gunnari* and *N.gibberifrons* in other parts of statistical area 48 as recommended by the Committee. The Commission agreed that Resolution 3/IV should remain in force and noted that French authorities had implemented conservation measures.	measures recommended by the Committee.

Year	Scientific Advice	Decisions Made	Summary
1987	From the Scientific Committee Report.[638] In relation to *N.rossii* the Committee recommended at paragraph 5.45 that: "The immediate objective for this stock should be to rebuild the spawning stock as quickly as possible. Preferably no catches should be taken at all, but it was recognised that this would be impracticable if commercial fishing for the other species continues." The Committee recommended that current conservation measures remain in force. In relation to Krill resources the Committee agreed that" it should continue to attach high priority to gathering the types of information necessary for detecting the effects of fishing	From the Commission Report.[639] The Commission decided to keep current conservation measures for *N.rossii* in force (paragraph 56). The Commission supported the request for more data in relation to Krill (paragraph 46).	The Commission implemented conservation measures based on Committees Advice. In the case of *C.gunneri* the Commission adopted a TAC that was higher than that recommended by the Committee but still within the range of uncertainty expressed by the Committee.

[638] I. Everson, 'Report of the Sixth Meeting of the Scientific Committee for the Conservation of Antartic Marine Living Resources' (CCAMLR, 3 November 1987).
[639] E. De Wilde, 'Report of the Sixth Meeting of the Commission for the Conservation of Antarctic Marine Living Resources' (CCAMLR, 6 November 1987).

Year	Scientific Advice	Decisions Made	Summary
	on krill stocks" (paragraph 4.7). To this end the Committee recommended that Member States collected further detailed information on fishing effort and catches (paragraph 4.45). The Committee recommended a TAC on *C.gunnari* of between 21000 and 31500 tonnes. The Committee noted that there would be significant benefits to the stock by increasing the age of first capture through measures such as mesh size regulations (paragraphs 5.52 and 5.63).	The Commission decided to place a TAC on *C.gunnari* of 35000 tonnes and prohibit all fishing for fin fish in the fishery area after that TAC is reached. This was above the level recommended by the Scientific Committee to achieve the level of mortality aspired to by the Commission. The Commission stated this TAC was appropriate because of the uncertainty around the actual biomass off the stock (conservation measure 8/VI (1987) and paragraphs 69 – 75). The Commission, in addition to imposing a TAC agreed to put in place a temporal closure	

Year	Scientific Advice	Decisions Made	Summary
		on *C.gunnari* between April and October (conservation measure 10/VI (1987) paragraph 76).	
1988	From the Scientific Committee Report.[640] In relation to *C.gunnari* the Committee found that the stock was variable with some years strong and others not, therefore 'pulsed' fishing was an acceptable exploitation strategy. The Committee recommended a TAC for 1989 of 10194 tonnes (paragraph 3.16). The Fish Stock Assessment Working Group of the Committee recommended a directed TAC (in sub-area 58.5.1) of 0 tonnes for *N.squamifrons* and a catch limit on by-catch of	From the Commission Report.[641] The Commission agreed with the Committee's assessment of *C.gunnari* and implemented the recommended TAC and closed the fishery immediately (as the TAC had already been exceeded) (conservation measure 9/VI (1988) and paragraph 88 and 89). The Commission did not discuss *N.squamifrons*.	The Commission discussed and accepted many of the Committees findings and implemented all the primary recommendations for krill and fin fish. However the Commission failed to discuss recommendations of the Fish Stock Assessment Working Group which had been endorsed by the Scientific Committee.

640 I. Everson, 'Report of the Seventh Meeting of the Scientific Committee for the Conservation of Antartic Marine Living Resources' (CCAMLR, 31 October 1988).

641 E. De Wilde, 'Report of the Seventh Meeting of the Commission for the Conservation of Antarctic Marine Living Resources' (CCAMLR, 8 November 1988).

Year	Scientific Advice	Decisions Made	Summary
	less than 2000 tonnes. (Annex 5 paragraph 96-108). The Working Group report was endorsed by the Scientific Committee but the specific assessment of *N.squamifrons* was not discussed.		
	The Committee recommended that the reporting of fine-scale krill catch data from sub-area 48.2 should continue. Similarly such data should also be reported from sub-area 48.1 and 48.3). Wherever possible, fine-scale effort data from all three areas should be collected (paragraphs 5.49).	The Commission agreed with and adopted all the Committees recommendations in relation to krill (paragraph 55-59).	
	The Committee did not provide a specific TAC recommendation for *P.guntheri*.	The Commission implemented a TAC of 13000 for *P.guntheri* based on the assessment of the Committee (Conservation 12/VII (1988) and paragraph 99).	

Year	Scientific Advice	Decisions Made	Summary
1989	From the Scientific Committee Report.[642] The Committee provided two different recommended TACs for *C.gunnari* based on the two different estimates of abundance. One recommendation was for a TAC of 6455 tonnes while the other was for a TAC of 22 235 tonnes. The Committee noted the large difference and the confusion this may give to the commission but decided to provide the estimates anyway (paragraph s 3.31-3.33).[643]	From the Commission Report.[644] The Commission regulated for a TAC of *C.gunnari* of 8000 tonnes this was based on the lower estimate of the stock from the Committee (which recommended 6455 tonnes) plus an additional amount for an area not covered by the survey which was the basis for the assessment (conservation measures 13/VII (1989) and paragraph 94).	The Commission was unable to set TACs for commercially exploited species when there was no consensus in the Committee (even though there was clear evidence that stocks were depleted) (see for example paragraphs 111-114).[645] The Commission was able to adopt many of the

[642] I. Everson, 'Report of the Eighth Meeting of the Scientific Committee for the Conservation of Antartic Marine Living Resources' (CCAMLR, 10 November 1989).
[643] The Committee provided the perhaps unnecessary advice that "In essence, if the trawl survey and the analysis based on it is correct, a TAC based on the CPUE tuned VPA will lead to a substantial depletion of the stock. If the analysis based on the CPUE tuned VPA is correct and a TAC is set on the basis of the trawl survey results, the stock will increase substantially." Ibid, para 3.31.
[644] M. Cortes, 'Report of the Eighth Meeting of the Commission for the Conservation of Antarctic Marine Living Resources' (CCAMLR, 17 November 1989).
[645] This dilemma was summed up in the report of the Commission starting at paragraph 118:
"118. Throughout this review, great difficulty was experienced in reconciling two opposing views. The first, held by most Members, was that in the absence of more detailed historical and current biological data, which should have been available from the fishery, thus allowing the WG-FSA to make stock assessments and provide management advice, it was prudent to set conservative TACs and provide as much protection as possible for juvenile fish.
119. The other view, held by the Soviet Union, was that in the absence of more detailed historical and current biological data from fishing vessels, management procedures should not be enacted."

Year	Scientific Advice	Decisions Made	Summary
	The Committee recommended a TAC of 0 tonnes (with no more than 300 tonnes of by-catch) for *N.gibberifrons* (paragraph 3.36). The Committee recommended a TAC of 0 tonnes in directed fishing (with a requirement for the minimum by-catch) for *P.georgianus* and *C.aceratus* (paragraph 3.38). The Committee recommended that conservation measures in force for statistical area 48 remain in force (paragraph 3.37).	The Commission agreed there would be no directed fishery for *N.gibberifrons* in sub-area 48.3 and by-catch would be restricted to not more than 300 tonnes (conservation measure 13/VII (1989) and paragraph 95). The Commission agreed that there should be no directed fishing for *P.georgianus* and *C.aceratus* as recommended by the Committee. The Commission could not reach a consensus on retention of conservation measure 1/III (closure of waters off South Georgia (statistical area 48) therefore the measure was not retained (paragraph 76).	measures recommended by the Committee and in some cases were able to adopt measures even in the absence of a scientific recommendation. However, in relation to many of the most important commercially exploited species consensus could not be reached in the Commission even where it was reached in the Committee. This was even more difficult where there was no consensus in the Committee. Often consensus failed due to the

Year	Scientific Advice	Decisions Made	Summary
	In relation to krill, the Committee recommended that there be reporting of fine-scale catch data in sub-areas 48, 1-3 (paragraph 2.47). Some in the Committee felt that the Commission should consider imposing a limit on the krill catch in area 48.3. Other members expressed doubts about this view. Krill productivity was very important for prey-predator interactions but there were no data on this. In addition they argued no functional relationship between krill and its dependent predators had been established. (Paragraph 2.48). The Committee made no findings in relation to *N.squamifrons* (the stock occurring in area 43) citing a lack of information – therefore	The Commission endorsed the recommendations of the Committee in relation to additional krill reporting (paragraphs 44-45). The Commission discussed the issue of conservation measures for krill, but like the Committee could not reach consensus, instead asking the Committee for additional information (paragraphs 47-50). The Commission directed that there be no directed fishing for *N.squamifrons* based on the	reluctance of one member (the USSR) to agree. This led to many measures failing to be adopted. In each case the Commission was candid in setting out the reasons, often simply stating that the USSR could not agree.

Year	Scientific Advice	Decisions Made	Summary
	no recommendations were made (paragraph 3.39). However in relation to the stock occurring in area 58 the Committee assessed that by-catch should be reduced (paragraph 3.64). Some members of the Committee thought that where there were many species in an area with uncertain status that a partial closure of the area to fishing was warranted as the stock by stock approach would be ineffective. The Committee could not agree on this recommendation as the USSR did not support it (paragraph 3.48). The Committee recommended that in view of the current low levels *N.rossii*, all conservation measures should be kept in force (paragraph 3.27).	Committees view that there was not enough information to set a TAC (conservation measure 14/VII(1989) paragraphs 97-98). The Commission discussed the advice of the Committee that recovery of stocks where there was uncertainty could be achieved by closure and many members agreed, however the USSR wished to continue with a stock by stock approach so no consensus was reached (paragraphs 90-91).	

Year	Scientific Advice	Decisions Made	Summary
		The Commission, in the absence of specific recommendations decided to set a TAC for *P.guntheri* of 12000 tonnes (Conservation 16/VIII (1989) and paragraph 102).	
1990	From the Scientific Committee Report.[646] The Committee recommended that due to uncertainties, a conservative TAC should be adopted for *C.gunnari* to reduce the probability of over-exploiting the species (a TAC was provided as starting at 44000 tonnes, but many members thought that was too high and that it should be 14000) (paragraphs 3.39-3.41).	From the Commission Report.[647] In relation to *C.gunnari* in 48.3 the Commission, after some disagreement settled on a TAC of 26000, which was in-between the two TACs recommended by the Committee. They also put in place limits on the by-catch of *N.gibberifrons C.aceratus, N.squamifrons* and *P.georgianus* in accordance with the recommendations of the scientific committee (paragraph 13.15, conservation measure 20/IX(1990)).	The Commission adopted many of the catch limits recommended by the Committee. However, many of the catch limits for species where the science was disputed in the Committee were set higher than many delegations would have liked, often at the behest of the USSR.

646 I. Everson, 'Report of the Ninth Meeting of the Scientific Committee for the Conservation of Antartic Marine Living Resources' (CCAMLR, 29 October 1990).
647 M. Cortes, 'Report of the Ninth Meeting of the Commission for the Conservation of Antarctic Marine Living Resources' (CCAMLR, 2 November 1990).

Year	Scientific Advice	Decisions Made	Summary
	In relation to *D.eleginoides* in sub-area 48.3 the Committee recommended at TAC of approximately 1200 tonnes (paragraph s 3.58-3.59). The Committee also recommended that the Commission consider a closed season from July (paragraph 3.65).	In relation to *D.eleginoides* the Commission set a TAC of 2500 tonnes. This was much greater than recommended by the committee, as the USSR objected to the recommendation, arguing that one of the basis for the assessment had been shown to be false therefore the assessments could not be relied upon (paragraphs 13.28-13.29 and 13.35-13.37). There was no discussion of a closed season.	The Commission did not put in place a closed season for In relation to *D.eleginoides* in sub-area 48.3 even though it was recommended by the Scientific Committee. The Commission could also not agree to new mesh size limitations because the USSR was unable to agree.
	For N.*gibberifrons C.aceratus, N.squamifrons* and *P.georgianus* (in sub-area 48.3) the Committee recommended a prohibition on directed fishing with a by-catch TAC of 300-500 tonnes (paragraph s 3.69, 3.71 and 3.73).	The Commission, based on the Committee's advice, adopted a prohibition on directed fishing for *N.gibberifrons, N.squamifrons, C.aceratus* and *P.georgianus* in sub-area 48.3 (paragraph 13.40, Conservation Measure 22/IX(1990)).	

Year	Scientific Advice	Decisions Made	Summary
	In division 58.4.4 (Ob and Lena Banks) the Committee recommended a TAC of 305 (Lena Bank) and 267 (Ob bank) tonnes of *N.squamifrons* (paragraphs 3.94 and 3.96). The Committee recommended a range of mesh size limitations in statistical area 48 as an update to Conservation Measure 2/III which was due for review (paragraph 3.18).	In division 58.4.4 (Ob and Lena Banks) the Commission adopted the Scientific Committee's recommendation for *N.squamifrons* (paragraph 13.44, conservation measure 28/IX(1990)). The Commission noted that Conservation Measure 2/III was due for review but reported that a consensus could not be reached on new mesh sizes as the USSR indicated that it could not agree to new mesh size limitations (paragraph 82). The Commission closed 48.1 and 48.2 for fishing in the 1990/91 fishing season (paragraph 13.42, Conservation Measure 27/IX(1990)) this was not based on a specific Committee recommendation.	

Year	Scientific Advice	Decisions Made	Summary
	The Committee found that there should be no directed fishing for *N.rossii* or *C.gunnari* around Kerguelen, division 58.5.1 (paragraphs 3.83 and 3.88). In relation to *N.squamifrons* around Kerguelen, division 58.5.1, the Committee advised that a continuation of the current (low fishing levels) would prevent recovery of the stock (paragraph 3.85). Based on the uncertainty surrounding krill the Committee recommended in the absence of any reliable estimate of the potential yield of krill in sub-area 48.3, that the Commission consider imposing precautionary measures for limiting krill fishing in sub-area 48.3. The delegations of Japan and USSR expressed the view that the introduction of precautionary	The Commission endorsed the advice of the Scientific Committee in respect of directed fisheries for *N.rossii, N.squamifrons, C gunnari* and *D.eleginoides* in division 58.5.1 (paragraph 13.45) but did not adopt any conservation measures in relation to that advice. The Commission, like the Committee was still unable to agree on any precautionary limits on krill harvesting. The Commission's report indicated that "one delegation" did not think such measures were necessary (paragraphs 4.15-4.16).	

Year	Scientific Advice	Decisions Made	Summary
	limits on krill was not yet justified because of the lack of estimates of the total biomass and the potential yield (paragraphs 2.76-2.77).		
1991	From the Scientific Committee Report.[648] The Committee recommend an annual catch limit of 1.5 million tonnes for krill in statistical area 48. (Paragraph 3.104).[649] The Committee was unable to recommend a TAC for *D.eleginoides* in sub-area 48.3 due to disagreements but did present the range of TACs discussed (between 794 and 8819	From the Commission Report.[650] The Commission, in adopted a TAC for krill of 1.5 million tonnes, including a limit of 620000 in any one sub-area (conservation measure 32/X (1991) and paragraph 48.1 - 3). The Commission set a TAC of 3500 tonnes for *D.eleginoides* in sub-area 48.3 (conservation measure 35/X(1991)).	The Commission acted on all recommendations from the Committee including setting TACs at the conservative end of recommendations and implementing some precautionary measures not recommended by consensus in the committee

648 O. Østvedt, 'Report of the Tenth Meeting of the Scientific Committee for the Conservation of Antartic Marine Living Resources' (CCAMLR, 25 October 1991).
649 The Committee placed several caveats on the TAC for krill ": first, the limit needs to be divided into sub-areas to allow for the possible interactions between krill populations in these sub-areas, second, it may need to be supplemented by other management measures to ensure that the catch is not entirely concentrated in the foraging range of colonies of vulnerable land breeding predators. Currently much of the krill catch in Statistical Area 48 is taken in such areas (SC-CAMLR-X/BG/7 and WG-Krill- 91/39); Third, the limit has not involved an allowance for possible unreported mortality of krill associated with fishing operations (although there was very limited information on the matter)." paragraph 3.105.
650 J. Berguno, 'Report of the Tenth Meeting of the Commission for the Conservation of Antarctic Marine Living Resources' (CCAMLR, 1 November 1991).

Year	Scientific Advice	Decisions Made	Summary
	tonnes), while also drawing the Commissions attention to the problem of sea bird mortality in this fishery (paragraphs 4.63 – 4.67).		
	The Committee recommended a precautionary TAC for E.*carlsbergi* could be set in the range 245000 to 398000 tonnes for the whole of sub-area 48.3 and in the range 32700 to 53000 tonnes for the Shag Rocks shelf region (paragraphs 4.80-4.83).	The Commission limited the catch of *E.carlsbergi* to 245000 tonnes in sub-area 48.3 which includes a limit of 53000 tonnes in the area around Shag Rocks (Conservation Measure 38/X (1991)).	
	Most members of the Committee recommended that Conservation Measure 27/IX (a ban on fishing in sub-areas 48.1 and 48.2) should be retained (paragraphs 4.88 and 4.92).	The Commission retained the prohibition on the capture of finfish in sub-areas 48.1 and 48.2 (conservation measures 41/X (1991) and 42/X (1991)).	
	The Committee recommended the closure of the fisheries for N.*squamifrons*, in division 58.4.4 (Ob and Lena Banks).	The Commission prohibited the capture of *N.squamifrons*, in division 58.4.4 (Ob and Lena Banks).	

Year	Scientific Advice	Decisions Made	Summary
	The Committee recommended for *N.rossii, N.squamifrons, P.guntheri, P.georgianus* and *C.aceratus*, in sub-area 48.3, that all management measures currently in place should remain (paragraph 4.25-4.28). The Committee was unable to recommend (due to disagreements) a TAC for *C.gunnari* in sub-area 48.3 but the reported opinions of the group were in the range of 8400 to 61900 tonnes (paragraph 4.46). The Committee did not provide a conclusive recommendation to the Commission for *N.gibberifrons* in sub-area 48.3 only indicating a by-catch TAC of 1500 or 3000 tonnes would be appropriate (paragraphs 4.69 - 4.71).	The Commission continued the prohibition on directed fishing for *C.gunnari*, *N.gibberifrons*, *C.aceratus, P.georgianus, N.squamifrons* and *P.guntheriin* sub-area 48.3 (Conservation Measures 33/X (1991) and 34/X (1991)) The Commission limited the by-catch, in sub-area 48.3, of N.*gibberifrons* to 500 tonnes and the by-catch of: *N.rossii, N.squamifrons, C.aceratus, P.georgianus* and *C.gunnari* shall not exceed 300 tonnes (Conservation Measure 38/X (1991)).	

Year	Scientific Advice	Decisions Made	Summary
	The Scientific Committee agreed that reactive management - the practice of taking management action only when the need for it has become apparent - is not a viable long-term strategy for the krill fishery. Some form of feedback management, which involves the continuous adjustment of management measures in response to information, is to be preferred as a long-term strategy. In the interim a precautionary approach is desirable and in particular a precautionary limit on annual catches should be considered" (paragraph 3.103). The problem of data reporting also occurred in relation to fin fish with the Committee reporting that "The work of WG-FSA has always been hampered by incomplete submissions of data. Various data, requested		

Year	Scientific Advice	Decisions Made	Summary
	by WG-FSA, were not submitted. The problem is most serious for data relating to the commercial fisheries" (paragraph 4.12).		
1992	From the Scientific Committee Report.[651] The Committee recommended a TAC for krill of 1.5 million tonnes in area 48 (with additional limits for sub-areas) (paragraph 2.66). The Committee recommended a precautionary catch limit of 390000 tonnes for krill in division 58.4.2 (paragraph 2.113)	From the Commission Report.[652] The Commission implemented a TAC for krill in 1.5 million tonnes in area 48, with additional limitations by sub-area (conservation measure 46/XI(1992)). The Commission implemented a TAC for krill in division 58.4.2 of 390000 tonnes (conservation measure 45/XI(1992)).	The Commission adopted conservation measures in line with the recommendations of the Committee. The only exception to this was in relation to sub-area 58.5.1 where the Commission endorsed the Committees advice but did not implement a conservation measures. Where the

651 O. Østvedt, 'Report of the Eleventh Meeting of the Scientific Committee for the Conservation of Antartic Marine Living Resources' (CCAMLR, 30 October 1992).

652 J. Berguno, 'Report of the Eleventh Meeting of the Commission for the Conservation of Antarctic Marine Living Resources' (CCAMLR, 6 November 1992).

Year	Scientific Advice	Decisions Made	Summary
	The Committee had disparate views on the commencement of directed fishing on *C.gunnari* in sub-area 48.3, with some advocating a prohibition while others sought a TAC (paragraph 3.63). The Committee recommended a *C.gunnari TAC* for sub-area 48.3 of 9200 tonnes (paragraph 3.68). The Committee could not provide advice on a TAC for *E.carlsbergi* as there was not enough data (paragraphs 3.73-3.74).	The Commission implemented a TAC for *C.gunnari* sub-area 48.3 of 9200 tonnes (conservation measure 49/XI(1992) and paragraph 9.18). The Commission implemented a TAC for *E.carlsbergi* of 245000 tonnes in sub-area 48.3 including a limit of 53000 tonnes in the Shag Rocks region[653] (conservation measure 53/XI(1992) and paragraph 9.24). The Commission implemented a TAC for *D.eleginoides* in sub-area 48.3 of 3350 tonnes[654]	Committee could not make a recommendation the Commission used alternate means to determine the appropriate conservation measure.

653 This TAC was implemented despite the absence of scientific advice, although there was some disagreement in the Commission they agreed to implement a TAC based on the previous year's catch paras 9.22 – 9.24

654 This TAC was set on the basis of advice from the Committee that a TAC within a range would be appropriate. The Commission adopted a TAC within that range but only after considerable debate about where it should be set, paras 9.26 - 9.38

Year	Scientific Advice	Decisions Made	Summary
	The Committee recommended a TAC in the range 750 to 5370 tonnes for *D.eleginoides* in sub-area 48.3 (paragraph 3.79).	(conservation measure 55/XI (1992) and paragraph 9.38).	
	The Committee was concerned at the rapid expansion of the fishery for *D.eleginoides* in division 58.5.1. The Committee recommended a TAC of 1100 tonnes for the western trawling grounds and also recommended that a TAC be established for the northern trawling grounds substantially below the catch taken in the 1991/92 season (paragraph 3.90).	The Commission endorsed the advice of the Committee, however no conservation measures was implemented (paragraph 4.18).	
	The Committee recommended a prohibition on the directed fishing for *N.gibberifrons* *C.aceratus* and *P.georgianus* in sub-area 48.3 (paragraph 3.71).	The Commission prohibited directed fishing on *N.gibberifrons, C.aceratus, P.georgianus, N.squamifrons* and *P.guntheri* in sub-area 48.3 for the 92/93 and 93/94 seasons (Conservation Measure 48/XI(1992)).	

Year	Scientific Advice	Decisions Made	Summary
	The Committee recommended that the fishery for *C.gunnari* in sub-area 48.2 remain closed until a survey is conducted and a more accurate estimate of the status of the stock has been obtained (paragraph 3.84). The Committee supported the application by Chile to conduct the exploratory fishery for *D.eleginoides*. The Committee noted the use of just one vessel conducting only one trip of 40 days and that a maximum of 240 tonnes would be taken (paragraphs 3.44-3.45). The Committee recommended a prohibition on bottom trawling in the *C.gunnari* fishery in sub-area 48.3 (paragraph 3.68). The Committee recommended a precautionary catch limit for an exploratory	The Commission continued the prohibition on capture of fin fish in sub-areas 48.1 and 48.2 (conservation measures 57/XI(1992) and 58/XI(1992) and paragraphs 9.40 – 9.43). The Commission put in place a TAC for the Chilean exploratory fishery of *D.eleginoides* in sub-area 48 of 240 tonnes (conservation measure 44/XI(1992) and paragraphs 8.1-8.4). The Commission banned the use of bottom trawls in the bottom trawls in the directed fishery for *C.gunnari* in sub-area 48.3 (conservation measure 49/XI(1992)). The Commission set up precautionary limits for the new crab fishery in area 48. The first	

Year	Scientific Advice	Decisions Made	Summary
	crab fishery but could not agree on the level. Some members believed that 2200 tonnes was appropriate while others thought that 1000 tonnes were appropriate (paragraphs 4.19-4.20).	limit was a closed season of several months; the second was a limit of one vessel per member and the last was a limit of a catch of 1600 tonnes[655] (conservation measure 60/XI(1992) and paragraph 9.51).	
1993	From the Scientific Committee Report.[656] Most members of the Committee recommended a TAC of 28 tonnes for *D.eleginoides* in sub-area 48.4 (paragraph 3.22). Committee members could not reach consensus on a TAC for *D.eleginoides* (sub-area 48.3). Many members recommended a	From the Commission Report.[657] The Commission set a TAC of 28 tonnes for *D.eleginoides* in sub-area 48.4 (conservation measure 70/XII (1993) and paragraph 8.31). The Commission designated sub-area 48.3 a special scientific and protection area for the 1993/1994 season with a TAC of 1300 tonnes	The Commission noted the concerns of WG-FSA and the Scientific Committee that there had been substantial exploitation of *D.eleginoides* both within and outside the Convention Area, possibly from a single stock, and recognised the

655 This catch limit was created in-between two different figures recommended by different members of the Committee as the Committee could not reach consensus, paragraph 9.51 of the Commission's report.
656 K.-H. Kock, 'Report of the Twelth Meeting of the Scientific Committee for the Conservation of Antartic Marine Living Resources' (CCAMLR, 29 October 1993).
657 D. Hammer, 'Report of the Twelth Meeting of the Commission for the Conservation of Antarctic Marine Living Resources' (CCAMLR, 5 November 1993).

Year	Scientific Advice	Decisions Made	Summary
	TAC set in the range of 900 to 1700 tonnes, others suggested that the fishery should be closed until the uncertainty is resolved and one member suggested a TAC of 3000 tonnes (paragraphs 3.37-3.39). Two options for TACs of *C.gunnari* in sub-area 48.3 were endorsed by the Committee by the Working Group: (i) 9 200 tonnes; or (ii) providing that by-catches could be satisfactorily monitored and reported, a TAC of 13 000 to 21 000 tonnes could be considered (paragraph 3.44-3.45). The Committee recommended a TAC below 245000 for *E.carlsbergi* in sub-area 48.3 (paragraph 3.52).	and strict protocols to ensure that fishing conducted in the sub-area would assist the Committee with its fisheries assessment (Conservation Measure 69/XII). The Commission implemented a TAC for The total catch of *C.gunnari* in the 93/94 season, of 9200 tonnes in sub-area 48.3 (conservation measure 66/XII (1993) and paragraph 8.16). The Commission implemented a TAC for *E.carlsbergi* of 200000 tonnes in sub-area 48.3 (conservation measure 67/XII (1993) and paragraphs 8.19-8.22).	urgent need for the Parties to address this problem (paragraph 4.23). The Commission adopted measures recommended by the Committee and took a precautionary approach when the Committee was unable to provide consensus advice.

Year	Scientific Advice	Decisions Made	Summary
	The Committee recommended that a TAC of 1600 tonnes should be imposed for the crab fishery in area 48 (paragraph 4.26).	The Commission set a TAC on the crab fishery of 1600 tonnes in sub-area 48.3 (conservation measure 74/XII (1993) and paragraphs 8.33-8.34). The Commission limited fishing effort for the crab fishery to one vessel per member (conservation measure 74/XII).[658]	
	The Committee recommended a ban on bottom trawling for *C.gunnari* in sub-area 48.3 (paragraph 3.48).	The Commission prohibited the use of bottom trawls in the directed fishery for *C.gunnari* in sub-area 48.3 (conservation measure 66/XII (1993) and paragraph 5.12).	
	The Committee recommended a revision of the measures to prevent incidental mortality of sea birds from long-line operations (paragraph 10.33).	The Commission agreed to conservation measure 29/XII. This measure put in place measures to protect sea birds from long-lining (paragraphs 4.41-4.42).	

658 This measure was adopted due to the exploratory nature of the new crab fishery. (paras 8.32-8.37)

Year	Scientific Advice	Decisions Made	Summary
	The Committee recommended a ban on the use of bait boxes which use plastic packing bands (paragraph 10.34).	The Commission also put in place conservation measure 63/XII which regulated the use of plastic packaging bands, as these were causing seal mortality as debris in the Southern Ocean.	
1994	From the Scientific Committee Report.[659] The Committee found that previous estimates of *D.eleginoides* in sub-area 48.3 were invalid and could not agree on a new methodology, therefore there was no agreed biomass or yield data provided to the Commission (paragraphs 2.20-2.29). The Committee found it was unable to recommend a TAC or management measures for *D.eleginoides* (paragraph 2.29). This was not a consensus view (paragraph 2.44).	From the Commission Report.[660] The Commission set a TAC of 28 tonnes for *D.eleginoides* in sub-area 48.4 (conservation measure 77/XIII (1994)). The Commission acknowledged that the Committee could not agree on a method to assess biomass yield or a TAC for *D.eleginoides* in sub-area 48.3. In determining the TAC the Commission considered previous catches and the last reliable scientific reports (paragraphs 8.20 – 8.33). The Commission set a TAC of 2800 for	The Commission adopted those measures where consensus had been achieved in the Committee. Where the Committee could not make a recommendation based on a lack of data the Commission made a determination based on other information (such as previous catches).

[659] K.-H. Kock, 'Report of the Thirteenth Meeting of the Scientific Committee for the Conservation of Antartic Marine Living Resources' (CCAMLR, 28 October 1993).
[660] D. Hammer, 'Report of the Thirteenth Meeting of the Commission for the Conservation of Antarctic Marine Living Resources' (CCAMLR, 4 November 1994).

Year	Scientific Advice	Decisions Made	Summary
	Some members of the Committee argued that the TAC for krill needed to be revised up to 4.1 million tonnes but the Committee was divided on this point (paragraph 5.33). The Committee found that the krill model could be used to revise its estimates of the yield of *E.carlsbergi* in sub-area 48.3. The members of the Committee recommended that the Commission reconsider a new precautionary limit for *E.carlsbergi* of 109000 tonnes (paragraph 2.45).	*D.eleginoides* in division 48.3 (conservation measure 80/XIII(1994)). The Commission retained the current TAC for krill, despite the disagreement in the Committee because the current catch was below the current TAC and because a precautionary approach required that the Commission remain with the lower TAC until the Committee could reach to consensus on an increase (paragraphs 8.4 – 8.6). The Commission noted that the Committee suggested that the TAC for *E.carlsbergi* should be revised based on an application of the krill model but some States expressed (scientific) reservations with this approach. As the Commission could not agree the TAC was based on that of the previous year (paragraphs 8.40-8.46). The Commission implemented a	In the case of Krill the Commission adopted the most precautionary of the Committees recommendations (made easier as catches were below the TAC level) However in relation to *E.carlsbergi* the Commission could not act to implement a more precautionary TAC based on the recommendation of some members. This was because members of the Commission raised concerns over the scientific basis of that recommendation.

Year	Scientific Advice	Decisions Made	Summary
		TAC for *E.carlsbergi* of 200000 tonnes in sub-area 48.3 (conservation measure 84/XIII (1994)).	
	In sub-area 58.5.2 the Committee recommended that a precautionary TAC be set for *C.gunnari* at 311 tonnes and a precautionary TAC for the trawl fishery of *D.eleginoides* at 297 tonnes (paragraph 2.71).	The Commission set a precautionary TAC of 311 tonnes for *C.gunnari* in sub-area 58.5.2 (conservation measure 78/XIII(1994)). The Commission set a TAC of 297 for *D.eleginoides* in sub-area 58.5.2[661] (conservation measure 78/XIII(1994)).	
	The Committee recommended at TAC of 1600 for the crab fishery in sub-area 48. 3(paragraph 3.6).	The Commission set a TAC for the crab fishery in sub-area 48.3 of 1600 tonnes (conservation measure 79/XIII(1994)). The Commission limited effort in the crab fisheries of sub-area 48.3 to one vessel per member and to the use of pots; all other fishing methods	

[661] This Conservation measure included the restriction that the TAC could only be taken by trawling.

Year	Scientific Advice	Decisions Made	Summary
	The Committee recommended that the fishery for *C.gunnari* in sub-area 48.3 be closed for the 1994/95 fishing season (paragraph 3.37).	were prohibited (conservation measure 79/XIII(1994)). The Commission prohibited directed fishing for *C.gunnari* in sub-area 48.3 (conservation measure 86/XIII(1994) and paragraph 8.34).	
1995	From the Scientific Committee Report.[662] Given uncertainties in recruitment the Committee agreed not to recommend a change in TAC for krill in area 48 (paragraph 4.13). The Committee recommended, based on a best estimate of yield a TAC for krill of	From the Commission Report.[663] The Commission did not change the TAC for Krill in area 48. The Commission set a TAC for krill in sub-area 58.4.2 of 450000 tonnes (conservation measure 45/XIV (1995) and paragraph 8.11).	The Commission adopted the conversation measures recommended by the Committee.

662 K.-H. Kock, ' Report of the Fourteenth Meeting of the Scientific Committee for the Conservation of Antartic Marine Living Resources' (CCAMLR, 27 October 1995).
663 J. Villemain, 'Report of the Fourteenth Meeting of the Commission for the Conservation of Antartic Marine Living Resources' (CCAMLR, 3 November 1995).

Year	Scientific Advice	Decisions Made	Summary
	450000 tonnes in sub-area 58.4.2 (paragraph 4.29).		
	A majority of the Committee recommended that no TAC be set for *C.gunnari* in sub-area 48.3 due to uncertainty; other members thought that a TAC should be set at a level below 13295 tonnes. The Committee could not come to consensus on this stock (paragraph 4.70).	The Commission set at TAC of 1000 tonnes for *C.gunnari* in sub-area 48.3 (conservation measure 97/XIV(1995) and paragraphs 8.21-8.32).	
	The Committee recommended that TACs for *E.carlsbergi* should be 14500 tonnes for the region around Shag Rocks and 109000 tonnes for all of sub-area 48.3, as recommended in 1994 (paragraph 4.72).	The Commission adopted the precautionary TAC of 109000 tonnes for *E.carlsbergi* in sub-area 48.3 (conservation measure 96/XIV(1995) and paragraph 8.33).	
	The Committee recommended that Conservation Measure 78/XIII, establishing a TAC of 311 tonnes for *C.gunnari* and 297	The Commission set a TAC of 311 for *C.gunnari* in sub-area 58.5.2; and a TAC of 297	

Year	Scientific Advice	Decisions Made	Summary
	tonnes for *D.eleginoides* in division 58.5.2 should remain in force (paragraph 4.97). For *D.eleginoides* in 48.3 the Committee found that based on the generalised yield model indicated that to have a probability of no greater than 10% that the spawning stock biomass will fall to below 20% of its unexploited level, the annual catch should not exceed 4000 tonnes (paragraph 4.52). The Committee recommend that the *C.gunnari* fishery in division 58.5.1 should be closed until at least the 1997/98 season (paragraph 4.83). The Committee recommended a new fishery plan for *D.eleginoides* and *D.mawsoni* in division	tonnes for *D.eleginoides* in division 58.5.2. (conservation measure 78/XIV(1995)) The Commission adopted a TAC for *D.eleginoides* in sub-area 48.3 of 4000 tonnes (conservation measure 93/XIV(1995) and paragraphs 8.13-8.16). The Commission endorsed the application of the year one decision rule to *D.eleginoides* in sub-area 48.3. It acknowledged that the choice of a probability level was both a scientific and policy question" (paragraph 4.19). The Commission endorsed the Committee's advice in relation to *C.gunnari* in division 58.5.1 (paragraph 4.21). The Commission put in place a plan for the new fishery of *D.eleginoides* and *D.mawsoni* in	

Year	Scientific Advice	Decisions Made	Summary
	58.4.3, including a combined TAC of 200 tonnes (paragraph 8.3). The Committee recommended a new fishery plan for deep-water species in division 58.4.2, including a TAC of 50 tonnes for each species (paragraph 8.3).	division 58.4.3, including a combined TAC of 200 tonnes (conservation measure 88/XIV(1995) and paragraphs 6.1-6.2). The Commission put in place a plan for the new fishery of deep-water species in division 58.4.2, including a TAC of 50 tonnes for each species, limited to bottom trawl only (conservation measure 89/XIV(1995) and paragraphs 6.1-6.2).	
1996	From the Scientific Committee Report.[664] The Committee recommended a TAC for krill of 775000 tonnes for area 58. (paragraph 4.27)	From the Commission Report.[665] The Commission implemented a TAC for krill in 58.4.1 of 775000 tonnes (conservation measure 106/XV (1996) and paragraph 8.38).	The Commission followed the Committee's advice where it was provided and in most cases where advice could not be provided, due to a lack of information or

[664] K.-H. Kock, 'Report of the Fifteenth Meeting of the Scientific Committee for the Conservation of Antartic Marine Living Resources' (CCAMLR, 25 October 1996).
[665] J. Villemain, 'Report of the Fifteenth Meeting of the Commission for the Conservation of Antartic Marine Living Resources' (CCAMLR, 1 November 1996).

Year	Scientific Advice	Decisions Made	Summary
	The Committee advised that a catch of 5000 tonnes of *D.eleginoides* in sub-area 48.3 would be consistent with the model rules for preventing over-exploitation (paragraph 4.57). The Committee could not agree on a recommendation for *C.gunnari* in sub-area 48.3 given a lack of data. Some members thought the fishery should reopen with a TAC of 1300 tonnes while others thought no advice should be offered (paragraphs 4.68-4.69). The Committee recommended that current measures continue for *E.carlsbergi* in sub-area	The Commission implemented a TAC for *D.eleginoides* in sub-area 48.3 of 5000 tonnes (conservation measure 102/XV (1996) and paragraph 8.40). The Commission implemented a TAC for *C.gunnari* in 48.3 of 1300 tonnes (conservation measure 107/XV (1996) and paragraphs 8.45-8.51).[666] The Commission implemented a TAC for *E.carlsbergi* in sub-area 48.3 of 109000 tonnes	consensus, the Commission adopted the precautionary recommendations of the Committee (as opposed to the precautionary recommendations of some members of the Committee). This was particularly facilitated, as in previous years, by the Commissions pre-decision framework for TACs adopted in conservation measure 7/V.

[666] The US felt that the Commission wasn't following the Committees advice for a precautionary closed season in allow a limited commercial fishery to take the place of a scientific survey (para 8.48)

Year	Scientific Advice	Decisions Made	Summary
	48.3 as there was no new information (paragraph 4.78).	(conservation measure 103/XV (1996) and paragraph 8.57).	
	The Committee recommended a TAC for *D.eleginoides* in division 58.5.2 of 3800 tonnes (paragraph 4.107).	The Commission implemented a TAC for *D.eleginoides* in division 58.5.2 of 3800 tonnes (conservation measure 109/XV(1996) and paragraph 8.68).	
	The Committee recommended a TAC of 311 for *C.gunnari* in division 58.5.2 in the absence of additional information (paragraph 4.111).	The Commission set a TAC of 311 tonnes for *C.gunnari* in division 58.5.2 (conservation measure 110/XV(1996) and paragraph 8.68).	
	The Committee recommended that the closed season for on *P.gibberifrons, C.aceratus, P.georgianus, L.squamifrons and P.guntheri* in sub-area 48.3 continue based on a lack of new data (paragraph 4.77).	The Commission prohibited directed fishing on *P.gibberifrons, C.aceratus, P.georgianus*, *L.squamifrons* and *P.guntheri* in sub-area 48.3 for the 1996/97 season (conservation measure 100/XV (1996) and paragraph 8.59).	

Year	Scientific Advice	Decisions Made	Summary
	The Committee made several recommendations on the reporting requirements of new fisheries.	The Commission endorsed the Scientific Committee's advice on new fisheries (SC-CAMLR-XV, paragraph s 8.2, 8.3, 8.30, 8.34 and 8.35)" (paragraph 8.11) and put in place a new fishery regime for *M.hyadesi* in sub-area 48.3 including a TAC of 2500 tonnes and reporting obligations (conservation measure 99/XV(1996)). The Commission adopted new-fishing regulations for *D.eleginoides and D.mawsoni* in sub-area 48.6 (conservation measure 114/XV), sub-areas 88.1 and 88.2 (conservation measure 115/XV(1996)) and sub-areas 58.6, 58.7 and 58.4.4 (conservation measure 116/XV(1996) and paragraphs 8.13-8.29).	

Year	Scientific Advice	Decisions Made	Summary
1997	From the Scientific Committee Report.[667] The Committee recommended at TAC for *D.eleginoides* in sub-area 48.3 of 3300 tonnes (paragraph 5.54). The Committee recommended at TAC *C.gunnari* in sub-area 48.3 of 4520 tonnes. However the Committee also noted that there was considerable uncertainty in their assessments (paragraph 4.73). The Committee recommended at TAC for *D.eleginoides* in sub-area 58.5.2 of 3700 tonnes (paragraph 5.109).	From the Commission Report.[668] The Commission set a TAC of 3300 tonnes for *D.eleginoides* in sub-area 48.3 (conservation measure 124/XVI(1997) and paragraph 9.38). The Commission set a TAC of 4520 tonnes for *C.gunnari* in sub-area 48.3 (conservation measure 123/XVI (1997) and paragraph 9.45). The Commission set a TAC for *D.eleginoides* in sub-area 58.5.2 of 3700 tonnes (conservation measure 131/XVI (1997) and paragraph 9.39).	The Commission acted on the recommendations of the Committee and set TACs and conservation measures based on those recommendations. Where no recommendation was possible they used other information such as previous years TACs. The exception was division 58.5.1 and the proposed closure which was not discussed.

[667] D. Miller, 'Report of the Sexteenth Meeting of the Scientific Committee for the Conservation of Antartic Marine Living Resources' (CCAMLR, 31 October 1997).
[668] D. Bock, 'Report of the Sixteenth Meeting of the Commission for the Conservation of Antartic Marine Living Resources' (CCAMLR, 7 November 1997).

Year	Scientific Advice	Decisions Made	Summary
	The Committee recommended at TAC *C.gunnari* in sub-area 58.5.2 of 600 tonnes (paragraph 5.115).	The Commission put in place special conservation measures for species in area 58.5.2 (conservation measure 132/XVI (1997) and paragraph 9.40).	
	The Committee recommended that the fishery for *C.gunnari* in division 58.5.1 be closed (paragraph 5.104).	The Commission did not discuss the prohibition on directed fishing in division 58.5.1.	
	The Committee recommended that sub-areas 48.1 and 48.2 remain closed to all directed fishing, with the exception of approved new fisheries (paragraphs 5.33-5.38).	The Commission prohibited the directed fishing for finfish except for *Dissostichus* spp. in sub-areas 48.1 and 48.2 (conservation measures 72/XVI(1997) and 73/XVI (1997) and paragraph 9.6).	
	The Committee advised it could not undertake assessments for *Dissostichus* spp. in sub-areas 58.4.1 or 58.4.2 due to a lack of information (paragraph 4.237).	The Commission prohibited directed fishing for *Dissostichus* spp. in sub-areas 48.5, 58.4.1 and 58.4.2 (conservation measure 120/XVI (1997) and paragraph 9.53).	

Year	Scientific Advice	Decisions Made	Summary
	The Committee recommended a variety of conservation measures for-by catch species in area 58.5.2 (paragraph 5.121). The Committee recommended a range of measures for new fisheries throughout the Convention Area (paragraphs 9.12 – 9.102). The Committee recommended that the fishery for *L.squamifrons* in division 58.4.4 be closed until a biomass survey could be conducted (paragraph 5.95).	The Commission prohibited directed fishing on *G.gibberifrons, C.aceratus, P.georgianus, L.squamifrons* and *P.guntheri* in sub-area 48.3 (conservation measure 127/XVI(1997) and paragraph 9.2). The Commission adopted measures to protect new *D.eleginoides* and *D.mawsoni* fisheries (conservation measures 134/XVI(1997), 135/XVI(1997), 136/XVI(1997), 137/XVI(1997), 138/XVI(1997), 139/XVI(1997), 140/XVI(1997), 141/XVI(1997), 142/XVI(1997), 143/XVI(1997) and 144/XVI(1997)). The Commission prohibited directed fishing for *L.squamifrons* in sub-area 58.4.4 (conservation measure 129/XVI (1997) and paragraph 9.8).	

Year	Scientific Advice	Decisions Made	Summary
1998	From the Scientific Committee Report.[669] The Committee found that it had insufficient new information to warrant a reassessment of the precautionary catch limits for krill (paragraph 5.16). For *D.eleginoides* in sub area 48.3 the Committee recommended a modest reduction in catch limit (paragraph 5.56). For *D.eleginoides* in division 58.5.2 the Committee recommended that the TAC should be revised to 3690 tonnes (paragraph 5.76).	From the Commission Report.[670] The Commission agreed to retain the current conservation measures for krill. The Commission set a TAC of 3500 tonnes for *D.eleginoides* in sub-area 48.3 (conservation measure 154/XVII (1998) and paragraph 9.26). The Commission set a TAC of 3690 tonnes for *D.eleginoides* in division 58.5.2 (conservation measure 158/XVII (1998) and paragraph 9.28).	The Commission adopted measures in accordance with the Committee's recommendations.

[669] D. Miller, 'Report of the Seventeenth Meeting of the Scientific Committee for the Conservation of Antartic Marine Living Resources' (CCAMLR, 30 October 1998).
[670] D. Bock, 'Report of the Seventeenth Meeting of the Commission for the Conservation of Antartic Marine Living Resources' (CCAMLR, 6 November 1998).

Year	Scientific Advice	Decisions Made	Summary
	For *C.gunnari* in sub area 48.3 the Committee recommended the TAC be revised to 4840 tonnes (paragraph 5.95). For *C.gunnari* in division 58.5.2 the Committee recommended the TAC be revised to 1160 tonnes (paragraph 5.105). The Committee had no new information on *C.aceratus, P.georgianus, G.gibberifrons, N.rossii, P.brevicauda guntheri* and *L.squamifrons* in sub-area 48.3 (paragraph 5.117). The Committee recommended that fisheries in sub-areas 58.6 and 58.7 be viewed with considerable caution given the uncertainty of the catch data and the high level of unreported fishing in the area (paragraph 4.155).	The Commission set a TAC of 4840 tonnes for *C.gunnari* in sub-area 48.3 (conservation measure 153/XVII(1998) and paragraph 9.35). The Commission set a TAC of 1160 tonnes for *C.gunnari* in division 58.5.2 (conservation measure 159/XVII (1998) and paragraph 9.36). The Commission prohibited directed fishing on *G.gibberifrons, C.aceratus, P.georgianus, L.squamifrons* and *P.guntheri* in sub-area 48.3 (conservation measure 152/XVII(1998) and paragraph 9.39). The Commission prohibited the taking of *D.eleginoides,* other than for scientific research purposes in in sub-area 58.7 (conservation measure 160/XVII (1998) and paragraph 9.30).	

Year	Scientific Advice	Decisions Made	Summary
1999	From the Scientific Committee Report.[671] The Committee did not have enough information to set a new precautionary limit on the catch of krill (paragraphs 4.13 and 4.14). The Committee did not consider *E.carlsbergi* in sub-area 48.3 during this meeting. The Committee recommended a TAC for *D.eleginoides* in area 48.3, based on a yield, of	From the Commission Report.[672] The Commission agreed that current conservation measures should remain force (paragraph 9.8). The TAC of *E.carlsbergi* in the 1999/2000 season was 109000 tonnes for sub-area 48.3. This was based on the previous catch limit as there was no new advice from the Committee (conservation measure 174/XVIII (1999) and paragraph 4.23). The Commission set a TAC for *D.eleginoides* in area 48.3 of 5310 tonnes (conservation	The Commission acted in accordance with the Committee's recommendations. Where the Committee made no recommendation the Commission acting with precaution based on earlier conservation measures.

671 D. Miller, 'Report of the Eighteenth Meeting of the Scientific Committee for the Conservation of Antartic Marine Living Resources' (CCAMLR, 29 October 1999).
672 D. Muthunayagam, 'Report of the Eighteenth Meeting of the Commission for the Conservation of Antartic Marine Living Resources' (CCAMLR, 5 November 1999).

Year	Scientific Advice	Decisions Made	Summary
	5310 tonnes, some States disagreed and recommended a lower TAC (paragraph 4.72). The Committee recommended that the TAC for *D.eleginoides in* sub-area 58.5.2 in the 1999/2000 season should be revised to 3585 tonnes (paragraph 5.86). The Committee recommended a TAC of 4036 tonnes for *C.gunnari* in sub-area 48.3 (paragraph 4.107). The Committee recommended a TAC of 916 tonnes for *C.gunnari* in division 58.5.2 (paragraph 4.117). The Committee recommended that there be a closed season from 1 March and 31 May to	measure 179/XVIII(1999) and paragraph 9.14). The Commission set a TAC for *D.eleginoides* in area 58.5.2 at 3585 tonnes in the 1999/2000 season (conservation measure 176/XVIII(1999) and paragraph 9.17). The Commission set a TAC *C.gunnari* in the 1999/2000 season was 4036 tonnes in sub-area 48.3 (conservation measure 175/XVIII(1999) and paragraph 9.20). The TAC for *C.gunnari* in division 58.5.2 was 916 tonnes in the 1999/2000 season (conservation measure 177/XVIII(1999) and paragraph 9.22). The Commission agreed to close the *C.gunnari* fishery in 48.3 from 1 March to 31 May. The	

Year	Scientific Advice	Decisions Made	Summary
	protect *C.gunnari* in sub-area 48.3 but members could not agree on where that should be (paragraphs 4.109 and 4.110).	Commission took a precautionary approach and included the whole of sub-area 48.3 in the closure (conservation measure 175/XVIII(1999) and paragraph 9.20).	
	The Committee recommended maintaining the current closure for G.*gibberifrons*, *C.aceratus*, *P.georgianus*, *L.squamifrons* and *P.guntheri* in sub-area 48.3 (paragraph 4.211).	Directed fishing on *G.gibberifrons*, *C.aceratus*, *P.sgeorgianus*, *L.squamifrons* and *P.guntheri* in sub-area 48.3 was prohibited by the Commission until a decision that the fishery be reopened could be made by the Commission based on the advice of the Committee (conservation measure 171/XVIII(1999) and paragraph 9.28).	
	The Committee continued to recommend a prohibition on directed fishing for *Dissostichus* spp. in sub-areas 48.5 and 88.3, and division 58.4.1 (east of 90°E) and 58.5.1 (paragraph 4.226).	Directed fishing for *Dissostichus* spp. in sub-areas 48.5 and 88.3, and division 58.4.1 (east of 90°E) and 58.5.1 was prohibited by the Commission from 1 December 1999 to 30 November 2000. Directed fishing by longlining in division 58.5.2 was prohibited from 1	

Year	Scientific Advice	Decisions Made	Summary
	The Committee recommended new measures and increased compliance with measures for the protection of sea birds (paragraphs 4.67, 4.75 and 4.81). The Committee recommend that the Commission allow and adopt conservation measures for the new fishery of *C.wilsoni, L.kempi, T.eulepidotus, P.antarcticum* and *Dissostichus* spp. (paragraph 4.13). The Committee recommended a nominal catch level of 500 tonnes for the new fishery	December 1999 to 30 November 2000 (conservation measure 172/XVIII(1999) and paragraph 9.18). The Commission adopted new measures for the protection of sea birds (conservation measure 173/XVIII(1999)). Fishing for *C.wilsoni, L.kempi, T.eulepidotus, P.antarcticum* and *Dissostichus* spp. by trawl in division 58.4.2 between the longitudes of 45°E and 80°E was limited to the new and exploratory fisheries by Australian-flagged vessels and included a TAC for all species of 1500 tonnes (conservation measures 186/XVIII(1999) and paragraph 9.56).	

Year	Scientific Advice	Decisions Made	Summary
	of *D.mawsoni* in division 58.4.2 (paragraph 9.51).	The Commission agreed to set a nominal catch limit of 500 tonnes for the exploratory fishery of *D.mawsoni* in division 58.4.2 (paragraph 7.23).	
2000	From the Scientific Committee Report.[673] The Committee made no recommendation as to a TAC for krill in area 48 or in division 58.4.1. The Committee did however advise the Commission that the yield in area 48 was 4 million tonnes and in division 58.4.1 of 440000 tonnes. The Committee also advised the Commission to subdivide the area further to ensure that there was not an over concentration of fishing effort (paragraphs 5.24 – 5.28).	From the Commission Report.[674] The Commission set a TAC for krill in area 48 of 4 million tonnes. This was divided into catches for each sub-area (conservation measure 32/XIX(2000) and paragraph 9.18). The Commission set a TAC for krill in sub-area 58.4.1 of 440000 tonnes, this was further divided within the area (conservation measure 106/XIX(2000) and paragraph 9.19).	The Commission acted in accordance with the Committee's recommendations and in some cases enacted further precautionary measures. Where the Committee made no recommendation the Commission acting with precaution based on earlier conservation measures.

[673] D. Miller, 'Report of the Nineteenth Meeting of the Scientific Committee for the Conservation of Antartic Marine Living Resources' (CCAMLR, 27 October 2000).
[674] V. Brukhis, 'Report of the Nineteenth Meeting of the Commission for the Conservation of Antartic Marine Living Resources' (CCAMLR, 3 November 2000).

Year	Scientific Advice	Decisions Made	Summary
	The Committee recommended a TAC of 4500 tonnes of *D.eleginoides* in sub-area 48.3 (paragraph 5.49). The Committee recommended a TAC of 2995 tonnes of *D.eleginoides* in division 58.5.2 (paragraph 5.63). The Committee recommended a TAC of 6760 tonnes of *C.gunnari* in sub-area 48.3 (paragraph 5.80). The Committee recommended a TAC of 1150 tonnes for *C.gunnari* in division 58.5.2 (paragraph 5.86). The Committee recommended that sub-area 48.5 and 88.3 be closed to directed fishing (paragraph 9.40 and 5.100).	The Commission set a TAC of 4500 tonnes for *D.eleginoides* in sub-area 48.3 (conservation measure 196/XIX(2000) and paragraph 9.22). The Commission set a TAC of 2995 tonnes for *D.eleginoides* in division 58.5.2. (conservation measure 197/XIX(2000) and paragraph 9.25)). The Commission set a TAC of 6760 tonnes for *C.gunnari* in sub-area 48.3 (conservation measure 194/XIX(2000) and paragraph 9.20). The Commission set a TAC of 1150 tonnes for *C.gunnari* in division 58.5.2 (conservation measure 195/XIX(2000) and paragraph 9.21). The Commission prohibited directed fishing for *Dissostichus* spp. in sub-areas 48.5, 88.3, 58.4.1 (except BANZARE Bank), 58.4.2 north	

Year	Scientific Advice	Decisions Made	Summary
	The Committee recommended that the Antarctic coastal area (south of 64°S) 58.4.1 be closed to fishing (paragraph 5.98).	of 64°S (except BANZARE Bank) and division 58.5.1. They also prohibited directed fishing by longlining in division 58.5.2 (conservation measure 192/XIX(2000) and paragraph 9.40). The Commission put in place by-catch protection measures for sub-area 58.5.2 include catch limits for by-catch species (conservation measure 198/XIX(2000) and paragraphs 9.27-9.29). The Commission put in place by-catch protection including catch limits in areas 58.4.1, 58.4.2 and 58.4.3 (conservation measure 201/XIX(2000) and paragraph 9.29).	
	The Committee could not make a recommendation relating to areas 58.4.2, 88.2 and 88.3 as there was insufficient data (paragraph 4.237).	The Commission also prohibited directed fishing for *Dissostichus* spp. in sub-area 88.2 north of 65°S and division 58.4.4 south of 60°S (conservation measure 193/XIX (2000) and paragraph 9.41 – this measure was not a specific recommendation of the Committee but rather complementary to it).	

Year	Scientific Advice	Decisions Made	Summary
	The Committee reported by-catch problems but made no specific recommendations (paragraphs 5.104-5.108).	The Commission revised conservation measures to protect sea-birds from longline fisheries (paragraph 9.12).	
2001	From the Scientific Committee Report.[675] The Committee recommended a TAC of 5820 tonnes for *D.eleginoides* in sub-area 48.3 (paragraph 5.35). The Committee recommend a TAC of 2815 tonnes for *D.eleginoides* in division 58.5.2 (paragraph 5.45). The Committee recommended a TAC of 5557 tonnes for *C.gunnari* fishery in sub-area	From the Commission Report.[676] The Commission set a TAC for *D.eleginoides* in sub-area 48.3 of 5820 tonnes (conservation measure 221/XX (2001) and paragraph 9.43). The Commission set a TAC for *D.eleginoides* in division 58.5.2 of 2815 tonnes (conservation measure 222/XX (2001) and paragraph 9.33). The Commission set a TAC for *C.gunnari* in sub-area 48.3 in the 2001/02 season of 5557	The Commission this year changed the way that they organised conservation measures. They started to place a range of additional provisions in the primary measures setting catch limits for target species, this included by-catch protection, method limits, closed seasons and data reporting. Previously these

[675] R. Holt, 'Report of the Twentieth Meeting of the Scientific Committee for the Conservation of Antartic Marine Living Resources' (CCAMLR, 26 October 2001).
[676] N. Sasanelli, 'Report of the Twentieth Meeting of the Commission for the Conservation of Antartic Marine Living Resources' (CCAMLR, 2 November 2001).

Year	Scientific Advice	Decisions Made	Summary
	48.3. The Committee recommended that no more than 25% of this be caught in the spawning season (paragraph 5.76). The Committee recommended a TAC of 885 tonnes for *C.gunnari* fishery in sub-area 58.5.2 (paragraph 5.90). The Committee recommended that there be a closed area within 12 n miles of South Georgia which should be established to protect concentrations of *C.gunnari* during the spawning season (paragraph 5.80).	tonnes, including a limit of 1389 tonnes between 1 March and 31 May 2002 (conservation measure 219/XX (2001) and paragraph 9.27). The Commission set a TAC for *C.gunnari* in sub-area 58.5.2 of 885 tonnes (conservation measure 220/XX (2001) and paragraph 9.29). The Commission limited the area open to fishing for *C.gunnari* in division 58.5.2 (conservation measure 220/XX (2001) and paragraph 9.29). The Commission noted that the Scientific Committee had not addressed the status of *E.carlsbergi* in sub-area 48.3, and no new management advice was available. In the absence of new information from this fishery,	had all been separate measures. The Commission agreed to the recommendations of the Committee and implemented most of them through binding conservation measures.

Year	Scientific Advice	Decisions Made	Summary
		the chair of the scientific committee advised that the elements of Conservation Measure 199/XIX may be carried forward to the 2001/02 season. Alternatively, the Commission may consider closing this fishery because no fishing had been reported since 1992" (paragraph 4.21). The Commission limited fishing of *C.gunnari* to trawling only (conservation measure 219/XX (2001) and paragraph 9.27 - sub-area 48.3 and 220/XX (2001) and paragraph 9.29 - sub-area 58.5.2). The Commission limited the fishery for *D.eleginoides* in sub-area 48.3 to fishing by pots and longlines only (conservation measure 221/XX (2001) and paragraph 9.43). In division 58.5.2 the fishery was limited to trawls	

Year	Scientific Advice	Decisions Made	Summary
	The Committee recommended a range of measures to protect by-catch of *Macrourus* spp. These measures include by-catch limits of 50 tonnes in 48.3 and 100 tonnes in sub-areas 48.6, 88.1 (south of 65°S), division 58.4.2, and on BANZARE Bank (paragraphs 5.118 -5.124).	only (conservation measure 222/XX (2001) and paragraph 9.33). The Commission agreed to protect *Macrourus* spp. in accordance with the recommendations of the Committee (paragraphs 9.39 – 9.44). The Commission put in place a range of conservation measures for the fishery in division 58.4.2 including precautionary catch limits (*Macrourus* spp. 150 tonnes and *Dissostichus* spp. 200 tonnes) (conservation measure 230/XX (2001) and paragraph 9.44).	
2002	From the Scientific Committee Report.[677]	From the Commission Report.[678]	The Commission implemented of the Committee's substantive

677 R. Holt, 'Report of the Twenty First Meeting of the Scientific Committee for the Conservation of Antartic Marine Living Resources' (CCAMLR, 25 October 2002).This year the Commission introduced a new numbering system for Conservation measures, the new numbering system used Arabic numbers and shows the category of the measure (first 2 digits), the number of the measure (second two digits) and the year is shown in brackets following the number.
678 N. Sasanelli, 'Report of the Twenty First Meeting of the Commission for the Conservation of Antartic Marine Living Resources' (CCAMLR, 1 November 2002).

Year	Scientific Advice	Decisions Made	Summary
	The Committee recommended that the catch limit for *D.eleginoides* in sub-area 48.3 be set at 7810 tonnes (paragraph 4.55). The Committee recommended a TAC for *D.eleginoides* in division 58.5.2 of 2879 tonnes (paragraph 4.67). The Committee recommended that the precautionary catch limit for *C.gunnari* in area 48.3 should be set at 2181 tonnes (paragraph 4.84). The Committee recommended a TAC for *C.gunnari* in division 58.5.2 of 2980 tonnes (paragraph 4.92). The Committee did not recommend a specific TAC for *D.eleginoides* in sub-area 48.6 but reported the catch was 455 tonnes in	The Commission set a TAC for *D.eleginoides* in sub-area 48.3 of 7810 tonnes (conservation measure 41-02 (2002) and paragraph 11.44). The Commission set a TAC for *D.eleginoides* in division 58.5.2 of 2879 tonnes (conservation measure 41-08 (2002) and paragraph 11.45). The Commission set a TAC for *C.gunnari* in sub-area 48.3 of 2181 tonnes (conservation measure 42-01 (2002) and paragraph 11.40). The Commission set a TAC for *C.gunnari* in division 58.5.2 of 2980 tonnes (conservation measure 42-02 (2002) and paragraph 11.41). The Commission set a TAC for *D.eleginoides* in sub-area 48.6 of 455 tonnes north of 60S and	recommendations. However they also implemented some conservation measures without scientific advice based on other sources of information.

Year	Scientific Advice	Decisions Made	Summary
	sub-area 48.6 in the area north of 60S and the area south of 60S (table 3.1).	455 tonnes south of 60S (conservation measure 41-04 (2002) and paragraph 11.60).	
	The Committee recommended that there should be prohibition of directed fishing for *D.eleginoides* in sub-area 58.7 (paragraph 4.72). The Committee recommended that there should be a prohibition on directed fishing for *D.eleginoides* in areas 58.6 and division 58.4.4 (paragraphs 4.106 and 4.108).	The Commission prohibited the taking of *D.eleginoides,* other than for scientific research purposes in area 58.6 and 58.7 (conservation measure 32-11 (2002), conservation measure 32-12 (2002) and paragraph 11.36). The Commission also prohibited the taking of *Dissostichus* spp., other than for scientific research purposes in area 58.4.4 (conservation measure 32-10 (2002) and paragraph 11.36).	
	The Committee made recommendations to Commission that it should consider closures of division 58.4.4 and sub-area 58.6 given the low levels of *Dissostichus* spp. and the large amount of IUU fishing and recommended that the Commission consider making division 58.4.4 a marine park.	The Commission prohibited directed fishing for *Dissostichus* spp. in sub-areas 48.5 and 88.2 north of 65°S and 88.3, and areas 58.4.1, 58.5.1 and 58.5.2 east of 79°20'E (in the parts of those areas outside EEZs (conservation measure 32-09 (2002) and paragraph 11.38).	

Year	Scientific Advice	Decisions Made	Summary
	The Committee recommended by-catch protection measures for area 58.5.2 (paragraphs 5.74-5.75).	The Commission put into place new measures for the regulation of exploratory fisheries (conservation measure 21-02 (2002) and paragraph 11.23 (this measure were on the Commission's own motion and were not the result of a Committee recommendation). The Commission put into place by-catch protection measures for area 58.5.2 (conservation measure 33-02 (2002) and paragraph 11.49).	
2003	From the Scientific Committee Report.[679] The Committee could not make a specific recommendation to set a TAC for	From the Commission Report.[680]	The Commission acted on the Committees recommendations, where the Committee could not

679 R. Holt, 'Report of the Twenty Second Meeting of the Scientific Committee for the Conservation of Antartic Marine Living Resources' (CCAMLR, 31 October 2003).
680 K. Yonezawa, 'Report of the Twenty Second Meeting of the Commission for the Conservation of Antartic Marine Living Resources' (CCAMLR, 7 November 2003).

Year	Scientific Advice	Decisions Made	Summary
	D.eleginoides in sub-area 48.3. This was due to problems identified with the model and the data series being used. Based on best estimates they recommended a TAC in the range of 4420 tonnes and promised a revision in 2004 (paragraphs 4.67-4.71). The Committee recommended a range of measures to manage the exploratory fishery for *Dissosrichus* spp. in division 58.4.2 (paragraphs 4.203-4.205). The Committee recommended a TAC for *D.eleginoides* in division 58.4.2 of 2873 tonnes (paragraph 4.89). The Committee could not make a specific recommendation for *C.gunnari* in sub-area 48.3 but did advise that the two assessments	The Commission set a TAC for *D.eleginoides* in sub-area 48.3 of 4420 tonnes (conservation measure 41-02 (2003) and paragraph 10.47). The Commission set a TAC for *Dissostichus* spp. in division 58.4.2 of 500 tonnes (conservation measure 41-05 (2003) and paragraph 10.49). The Commission set a TAC for *D.eleginoides* in division 58.4.2 of 2873 tonnes (conservation measure 41-08 (2003) and paragraph 10.52). The Commission set a TAC for C.gunnari in sub-area 48.3 of 2887 tonnes (conservation measure 42-01 (2003) and paragraph 10.64).	provide advice it determined alternate ways to make a decision.

Year	Scientific Advice	Decisions Made	Summary
	conducted had a range of 2205–3570 tonnes (paragraphs 4.110-4.111).		
	The Committee recommended that the TAC for *C.gunnari* in division 58.5.2 be revised to 292 tonnes (paragraph 4.117).	The Commission set a TAC for C.*gunnari* in division 58.5.2 of 292 tonnes (conservation measure 42-02 (2003) and paragraph 10.65).	
	The Committee recommended that the fishery for *E.carlsbergi* in sub-area 48.3 should be closed as there had not been enough information to conduct an assessment for several years (paragraphs 4.121-4.124).	The Commission also prohibited directed fishing for *E.carlsbergi* in sub-area 48.3 (conservation measure 32-17 (2003) and paragraph 4.62).	
	The Committee recommended the continuation of the closure of division 58.5.1 to directed fishing for *D.eleginoides* (paragraph 4.83).	The Commission prohibited directed fishing for *D.eleginoides* in division 58.5.1 (conservation measure 32-13 (2003) and paragraphs 10.37-10.39).	

Year	Scientific Advice	Decisions Made	Summary
		The Commission prohibited directed fishing for *D.eleginoides* division 58.5.2 east of 79°20'E and outside the EEZ to the west of 79°20'E. (conservation measure 32-14 (2003) and paragraphs 10.37-10.39)). This measure (like 32-15 (2003) and 32-16 (2003) below) was based on the Committees recommendation in 2001 that new fisheries not be allowed to start until the area had a survey completed and an assessment could be made.	
	The Committee could not provide scientific advice on setting catch limits in sub-area 88.2 but recommended not exceeding catches of previous years (paragraph 4.189).	The Commission prohibited directed fishing for *D.eleginoides* sub-area 88.2 north of 65°S (conservation measure 32-15 (2003) and paragraphs 10.37-10.39)).	
	The Committee provided no advice on fishing in sub-area 88.3 but noted there had not previously been fishing in that area (paragraph 4.166).	The Commission prohibited directed fishing for *D.eleginoides* in sub-area 88.3 (conservation measure 32-16 (2003) and paragraphs 10.37-10.39)).	

Year	Scientific Advice	Decisions Made	Summary
		The Commission put in place measures to limit by-catch in new and exploratory fisheries (conservation measure 33-03 (2003) and paragraph 10.43). This measure was not based on scientific advice but rather the reorganisation of a previous conservation measure. The Commission prohibited directed fishing for *Dissostichus* spp. in sub-area 48.5. (conservation measure 32-09 (2003) and paragraphs 10.30-10.31) This measure was not based on a recommendation from the Committee but rather previous conservation measures.	
	The Committee recommended new measures to mitigate sea-bird mortality, in particular further data reporting requirements and	The Commission introduced amendments to the conservation measures that aim to minimise the incidental mortality of seabirds	

Year	Scientific Advice	Decisions Made	Summary
	modification of some measures to apply to a wider variety of vessels (paragraphs 5.9 and 5.25). The Committee recommended that the precautionary yield for *M.carinatus* be considered the precautionary catch limit (360 tonnes) for the purpose of by-catch (paragraph 4.150).	(conservation measures 25-02 (2003) and 25-03 (2003) and paragraph 10.28 see also paragraphs 5.1-5.2). The Commission noted the Committees advice in relation to M.*carinatus* (paragraph 4.64) and put it in place through conservation measure 33-02 (2003).	
2004	From the Scientific Committee Report.[681] The Committee was unable to recommend a TAC for *D.eleginoides* in sub-area 48.3. The Committee informed the Commission of two potential assessment approaches one giving a potential TAC of 2000 tonnes, the other	From the Commission Report.[682] The Commission set a TAC for *D.eleginoides* in sub-area 48.3 of 3050 tonnes (conservation measure 41-02 (2004) and paragraph 10.50). Several States expressed concern that the Commission was making the decision on this TAC in the absence of consensus advice.	Despite the Committee not being able to provide updated advice on several important fisheries the Commission was able to implement measures based on other information and the information that was

681 R. Holt, 'Report of the Twenty Third Meeting of the Scientific Committee for the Conservation of Antartic Marine Living Resources' (CCAMLR, 29 October 2004).
682 K. Yonezawa, 'Report of the Twenty Third Meeting of the Commission for the Conservation of Antartic Marine Living Resources' (CCAMLR, 2004).

Year	Scientific Advice	Decisions Made	Summary
	between 3050 and 3750 tonnes (paragraph 4.58). The Committee was unable to provide any specific advice on the exploratory fishery for *Dissostichus* spp. in division 58.4.2 (paragraphs 4.159-4.166). The Committee recommended a TAC for *D.eleginoides* in division 58.5.2 of 2787 tonnes (paragraph 4.75). The Committee recommended a TAC for C.gunnari in sub-area 48.3 of 3574 tonnes (paragraph 4.97). The Committee recommended a TAC for C.gunnari in division 58.5.2 of 1864 tonnes (paragraph 4.106).	 The Commission set a TAC for *Dissostichus* spp. in division 58.4.2 of 780 tonnes (conservation measure 41-05 (2004) and paragraphs 10.59-10.61). The Commission set a TAC for *D.eleginoides* in division 58.5.2 of 2787 tonnes (conservation measure 41-08 (2004) and paragraph 10.67). The Commission set a TAC for C.gunnari in sub-area 48.3 of 3574 tonnes (conservation measure 42-01 (2004) and paragraph 10.84). The Commission set a TAC for C.gunnari in division 58.5.2 of 1864 tonnes (conservation measure 42-02 (2004) and paragraph 10.94).	provided by the Committee. Where recommendations were made the Commission followed them.

Year	Scientific Advice	Decisions Made	Summary
	The Committee did not provide new assessments on by-catch limits in division 58.5.2 (or any division) (paragraphs 4.194-4.195). The Committee recommended revising measures to protect sea birds (paragraph 5.16).	The Commission put in place by-catch protection measures for sub-area 58.5.2 (conservation measure 33-02 (2004) and paragraph 10.38). The Commission put in place new measures to protect sea-birds (conservation measure 24-02 (2004) and paragraph 10.23).	
2005	From the Scientific Committee Report.[683] The Committee recommended a TAC for *D.eleginoides* in sub-area 48.3 of 3556 tonnes (paragraph 4.61). The Committee recommended TAC for *D.eleginoides* in sub-area 48.4 of 100 tonnes (paragraph 4.118).	From the Commission Report.[684] The Commission set a TAC for *D.eleginoides* in sub-area 48.3 of 3556 tonnes (conservation measure 41-02 (2005) and paragraph 11.44). The Commission set a TAC for *D.eleginoides* in sub-area 48.4 of 100 tonnes (conservation measure 41-03 (2005) and paragraph 11.46).	The Commission acted on the Committee's recommendations and enacted measures based on other information where the Committee could not make new recommendations.

683 E. Fanta, 'Report of the Twenty Fourth Meeting of the Scientific Committee for the Conservation of Antartic Marine Living Resources' (CCAMLR, 28 October 2005).
684 S. Lee, 'Report of the Twenty Fourth Meeting of the Commission for the Conservation of Antartic Marine Living Resources' (CCAMLR, 4 November 2005)

Year	Scientific Advice	Decisions Made	Summary
	The Committee recommended a TAC for *D.eleginoides* in division 58.5.2 of 2584 tonnes (paragraph 4.77). The Committee recommended a TAC for *C.gunnari* in sub-area 48.3 of 2244 tonnes (paragraph 4.100 – 4.101). The Committee recommended a TAC for *C.gunnari* in division 58.5.2 of 1210 tonnes (paragraph 4.106). The Committee was unable to make new recommendations on new limits for by-catch (paragraphs 4.179 and 4.186). The Committee recommended changes to the measures in place to protect incidental	The Commission set a TAC for *D.eleginoides* in division 58.5.2 of 2584 tonnes (conservation measure 41-08 (2005) and paragraph 11.56). The Commission set a TAC for *C.gunnari* in sub-area 48.3 of 2244 tonnes (conservation measure 42-01 (2005) and paragraph 11.91). The Commission set a TAC for *C.gunnari* in division 58.5.2 of 1210 tonnes (conservation measure 42-02 (2005) and paragraph 11.94). The Commission did note that the Committee had been unable to advise on new limits for by-catch, therefore measures represented the status quo (paragraph 4.49). The Commission endorsed the advice of the Committee in relation to incidental mortality	

Year	Scientific Advice	Decisions Made	Summary
	mortality of sea-birds (paragraph 5.19 and 5.53-5.55).	of sea birds (conservation measure 25-02 (2005) and paragraph 5.1). The Commission prohibited directed fishing for *Dissostichus* spp. except in accordance with specific conservation measures (conservation measure 32-09 (2005). This measure was a renewal of a previous measures, in the absence of new scientific advice. "The Commission agreed to extend the environmental protection implemented in the fisheries in sub-areas 88.1 and 88.2, to other fisheries operating south of 60°S. These environmental protection elements regulate the disposal of plastic packaging bands, the dumping or discharge of oil, garbage, food wastes, poultry, sewage, offal or incineration ash, and the translocation of poultry." These measures were not based on specific scientific	

Year	Scientific Advice	Decisions Made	Summary
		advice but rather on earlier agreed conservation measures (paragraph 11.40).	
2006	From the Scientific Committee Report.[685] The Committee recommended a TAC for *D.eleginoides* in sub-area 48.3 of 3554 tonnes (paragraph 4.125). The Committee recommended a TAC for *D.eleginoides* in sub-area 48.4 of 100 tonnes (paragraph 4.130). The Committee recommended a TAC for *D.eleginoides* in division 58.5.2 of 2427 tonnes (paragraph 4.86).	From the Commission Report.[686] The Commission set a TAC for *D.eleginoides* in sub-area 48.3 of 3554 tonnes (conservation measure 41-02 (2006) and paragraph 12.46). The Commission set a TAC for *D.eleginoides* in sub-area 48.4 of 100 tonnes (conservation measure 41-03 (2006) and paragraph 12.29). The Commission set a TAC for *D.eleginoides* in division 58.5.2 of 2427 tonnes (conservation measure 41-08 (2006) and paragraph 12.54).	The Commission acted on the Committee's recommendations and enacted measures based on other information where the Committee could not make new recommendations.

685 E. Fanta, 'Report of the Twenty Fifth Meeting of the Scientific Committee for the Conservation of Antartic Marine Living Resources' (CCAMLR, 27 October 2006).

686 S. Lee, 'Report of the Twenty Fifth Meeting of the Commission for the Conservation of Antartic Marine Living Resources' (CCAMLR, 3 November 2006).

Year	Scientific Advice	Decisions Made	Summary
	The Committee recommended a TAC for *C.gunnari* in sub-area 48.3 of 4337 tonnes (paragraph 4.113).	The Commission set a TAC for *C.gunnari* in sub-area 48.3 of 4337 tonnes (conservation measure 42-01 (2006) and paragraph 12.64).	
	The Committee recommended a TAC for *C.gunnari* in division 58.5.2 of 42 tonnes (paragraph 4.119).	The Commission set a TAC for *C.gunnari* in division 58.5.2 of 42 tonnes (conservation measure 42-02 (2006) and paragraph 4.59).	
	The Committee informed the Commission that there are sharks in exploitable quantities within CCAMLR waters (paragraph 11.18).	The Commission introduced measures to protect sharks (conservation measure 32-18 (2006) and 12.38).	
	The Committee recommended that recommended that the prohibition of directed fishing for *D.eleginoides,* remain in force (paragraph 4.79).	The Commission agreed to keep Conservation Measure 32-13, a prohibition on directed fishing for *D.eleginoides,* in force (paragraph 12.3).	
	The Committee recommended that the Commission put in place an interim prohibition on gillnets (paragraph 11.20).	The Commission introduced a prohibition on gillnetting (conservation measure 22-04 (2006) and paragraph 12.26).	

Year	Scientific Advice	Decisions Made	Summary
	The Committee discussed a prohibition on bottom trawling (paragraph 11.22). The Committee recommended changes to the measures limiting by-catch (paragraphs 5.26-5.27).	The Commission introduced a prohibition on the use of bottom trawling (conservation measure 22-05 (2006) and paragraph 12.28). The Commission introduced by-catch protection measures including catch limits (conservation measure 33-02 (2006) and paragraph 12.41).	
2007	From the Scientific Committee Report.[687] The Committee recommended that the catch limited for krill be revised to 2645 tonnes in sub-area 58.4.2 (paragraph 3.54).	From the Commission Report.[688] The Commission set a TAC for krill of 2 645 tonnes in sub-area 58.4.2 (conservation measure 51-03 (2007) and paragraph 13.75).	The Commission acted on the recommendations of the Committee and based conservation measures on other information such as previous measures where

687 E. Fanta, 'Report of the Twenty Sixth Meeting of the Scientific Committee for the Conservation of Antartic Marine Living Resources' (CCAMLR, 26 October 2007).
688 P. Amutenya, 'Report of the Twenty Sixth Meeting of the Commission for the Conservation of Antartic Marine Living Resources' (CCAMLR, 2 November 2007).

Year	Scientific Advice	Decisions Made	Summary
	The Committee recommended a TAC for *D.eleginoides* in sub-area 48.3 of be 3920 tonnes which could also be the TAC for 2008/2009 (paragraphs 4.57-4.58). The Committee recommended a TAC for *D.eleginoides* in division 58.5.2 of 2500 tonnes; this TAC could also be applied to 2008/2009 (paragraphs 4.73-4.74). The Committee recommended a TAC for *C.gunnari* in sub-area 48.3 of 2462 tonnes. It recommended at TAC of 1569 in 2008/2009 (paragraph 4.93). The Committee recommended a TAC for *C.gunnari* in division 58.5.2 of 220 tonnes (paragraph 4.99).	The Commission set a TAC for *D.eleginoides* in sub-area 48.3 of 3920 tonnes (conservation measure 41-02 (2007) and paragraph 13.54). The Commission set a TAC for *D.eleginoides* in division 58.5.2 of 2500 tonnes (conservation measure 41-08 (2007) and paragraph 13.63). The Commission set a TAC for *C.gunnari* in sub-area 48.3 of 2462 tonnes (conservation measure 42-01 (2007) and paragraph 13.72). The Commission set a TAC for *C.gunnari* in division 58.5.2 of 220 tonnes (conservation measure 42-02 (2007) and paragraph 13.73).	new advice was not available.

Year	Scientific Advice	Decisions Made	Summary
	The Committee recommended revising the terms of the conservation measures relating to Krill in area 48 to include the previously determined trigger point and to include a revised catch limit of 3.47 million tonnes (paragraphs 3.42-3.44). The Committee recommended revising the measures for the exploratory fishery of *Dissostichus* spp. in sub-area 48.6. In particular they did not think the current catch limit of 910 tonnes was precautionary (paragraph 4.128). The Committee recommended that there were measures that could be taken to better control bottom fishing (paragraphs 4.169 – 4 .171).	The Commission set a TAC for krill of 3.47 million tonnes in area 48 but further limited to 620000 tonnes until the Committee could reach agreement as to the division of the catch for sub-areas. The Commission did note the concerns of the Committee (Commission 51-01 (2007) and paragraph 13.74). The Commission agreed to revise catch-limits and protection measures for the exploratory fishery in 48.6 (conservation measure 41-04 (2007) and paragraph 13.55). The Commission put in place limitations on bottom fishing in order to protect vulnerable marine habitats (conservation measure 22-06 (2007) and paragraph 13.41).	

Year	Scientific Advice	Decisions Made	Summary
	The Committee suggested amendments to measures to protect sea-birds from incidental mortality (paragraph 5.24).	The Commission put in place new measures to reduce incidental mortality of sea-birds (conservation measure 25-02 (2007) and paragraph 13.27). The Commission put in place by-catch protection, including by-catch catch limits for 58.5.2, (conservation measure 33-02 (2007) and paragraph 13.50) and for new and exploratory fisheries (conservation measure 33-03 (2007) and paragraph 13.51). These measures were based on consideration of previous measures rather than on the advice of the Committee.	

Year	Scientific Advice	Decisions Made	Summary
2008	From the Scientific Committee Report.[689] The Committee recommended a TAC for *D.eleginoides* in sub-area 48.3 of 3920 tonnes (paragraph 4.53). The Committee recommended a catch limit of 75 tonnes for *Dissostichus* spp. in sub-area 48.4 (paragraph 4.97).	From the Commission Report.[690] The Commission set a TAC for *D.eleginoides* in sub-area 48.3 of 3920 tonnes. The catch limit was based on the 2007 Committee report (conservation measure 41-02 (2008) and paragraph 13.17). The Commission set a TAC for *Dissostichus* spp. in sub-area 48.4 of 75 tonnes, including limits on the species taken (conservation measure 41-03 (2008) and paragraph 13.34). The Commission set a TAC for *D.eleginoides* in division 58.5.2 of 2500 tonnes with spatial limitations. The catch limit was based on the	The Commission enacted conservation measures based on the recommendations of the Committee. Where the Committee could not make a recommendation the Commission still implemented other conservation measures. Unlike in previous years, the 2008 Commission report was unclear in many cases as to what scientific advice the Commission was relying on and where it wasn't based on

689 K. Sullivan, 'Report of the Twenty Seventh Meeting of the Scientific Committee for the Conservation of Antartic Marine Living Resources' (CCAMLR, 31 October 2008).
690 P. Amutenya, 'Report of the Twenty Seventh Meeting of the Commission for the Conservation of Antartic Marine Living Resources' (CCAMLR, 7 November 2008).

Year	Scientific Advice	Decisions Made	Summary
	The Committee recommended a TAC for *D.eleginoides* in division 58.5.2 west of 79°20'E of 2500 tonnes (paragraph 4.65). The Committee recommended a TAC for *C.gunnari* in sub-area 48.3 of 3834 tonnes (paragraph 4.82). The Committee recommended a TAC for *C.gunnari* in division 58.5.2 of 102 tonnes (paragraph 4.87). The Committee made recommendations on the alteration of conservation measures limiting incidental sea-bird mortality (paragraphs 5.24 -5.34).	2007 Committee report (conservation measure 41-08 (2008) and paragraph 13.18). The Commission set a TAC for *C.gunnari* in sub-area 48.3 of 3834 tonnes (conservation measure 42-01 (2008) and paragraph 13.53). The Commission set a TAC for *C.gunnari* in division 58.5.2 of 102 tonnes (conservation measure 42-02 (2008) and paragraph 13.54). The Commission put in place new measures for the weighting of long-lines in order to limit incidental sea-bird mortality (conservation measure 24-02 (2008) and a general measure on minimising of sea-bird by-catch (conservation measure 25-02 (2008) and paragraphs 13.14-13.15).	a recommendation, what the alternative source of information was.

Year	Scientific Advice	Decisions Made	Summary
	The Committee made various recommendations relating to the exploratory krill fishery in sub-area 48.6 but these did not include the catch limits set by the Commission as the Committee had insufficient information (paragraphs 4.25-4.29). The Committee expressed its concerned about the trigger point of 620000 tonnes of krill. They noted that while the catch was not yet near that level, contemplating, a catch of that magnitude may not be precautionary (paragraphs 3.30 – 3.35).	The Commission put in place measures to restrict an exploratory fishery of krill in sub-area 48.6 including a TAC of 15000 tonnes with spatial limitations (conservation measure 51-05 (2008) and paragraphs 13.56 – 13.59). The Commission noted the Committee's concerns that the current trigger points for distribution of krill catch between sub-areas may not be precautionary and as in the Committee many members agreed with this conclusion, however as there was no alternative trigger point the Commission could not reach consensus on a variation (paragraphs 4.10-4.13).	

Year	Scientific Advice	Decisions Made	Summary
2009	From the Scientific Committee Report.[691] The Committee recommended a revised TAC for *D.eleginoides* in sub-area 48.3 of between 2750 and 3950 tonnes for both the 09/10 and 10/11 season (paragraph 4.81). The Committee recommended a TAC for *Dissostichus* spp. in sub-area 48.4 of 75 tonnes in the southern area and 41 tonnes in the southern area (paragraphs 4.93 – 4.95). The Committee recommended a TAC for *D.eleginoides* in division 58.5.2 of 2550 tonnes	From the Commission Report.[692] The Commission set a TAC for *D.eleginoides* in sub-area 48.3 of 3000 tonnes for both 09/10 and 10/11 seasons (conservation measure 41-02 (2009) and paragraph 12.36). The Commission set a TAC for *Dissostichus* spp. in sub-area 48.4 of 75 tonnes in the southern area and 41 tonnes in the southern area (conservation measure 41-03 (2009) and paragraph 12.38). The Commission set a TAC for *D.eleginoides* in division 58.5.2 of 2550 tonnes with spatial limitations in both the 09/10 and 10/11	The Commission considered the recommendations of the Committee and enacted all those recommended by consensus but could not come to a conclusion on the trigger level for krill.

691 S. Iversen, 'Report of the Twenty Eighth Meeting of the Scientific Committee for the Conservation of Antartic Marine Living Resources' (CCAMLR, 30 October 2009).
692 D. MacKay, 'Report of the Twenty Eighth Meeting of the Commission for the Conservation of Antartic Marine Living Resources' (CCAMLR, 6 November 2009).

Year	Scientific Advice	Decisions Made	Summary
	for both the 09/10 and 10/11 season (paragraph 4.108). The Committee recommended a TAC for *C.gunnari* in sub-area 48.3 of 1548 tonnes in 09/10 and 949 tonnes in 10/11 (paragraph 4.126). The Committee recommended a TAC for *C.gunnari* in division 58.5.2 of 1658 tonnes in 09/10 and 0 tonnes in 10/11 (paragraph 4.133).	seasons (conservation measure 41-08 (2009) and paragraph 12.37). The Commission set a TAC for *C.gunnari* in sub-area 48.3 of 1548 tonnes (conservation measure 42-01 (2009) and paragraph 12.56). The Commission set a TAC for *C.gunnari* in division 58.5.2 of 1658 tonnes (conservation measure 42-02 (2009) and paragraph 12.57). The Commission put in place a prohibition on exploratory fishing for *Dissostichus* spp. in water less than 550m depth (conservation measure 22-08 (2009) and paragraph 12.30). This was based on consolidation of a variety of earlier conservation measures rather than specific advice.	

Year	Scientific Advice	Decisions Made	Summary
	The Committee recommended updating the definitions in the measures to minimise incidental mortality of sea-birds and marine mammals (paragraph 5.10). The Committee made recommendations for the exploratory krill fishery in sub-area 48.6, but this did not include a catch limit (paragraph 4.215 – 4.219). The Committee recommended a simple interim measure to distribute the krill TAC in area 48 (paragraph 4.36).	The Commission updated measures to minimise incidental mortality of sea-birds and marine mammals (conservation measures 25-02 (2009) and 25-03 (2009) and paragraphs 12.24 -12.28). The Commission put in place limitations on the exploratory fishery for krill in sub-area 48.6 including a catch limit of 15000 tonnes (conservation measures 51-05 (2009) and paragraph 12.58). The Commission put in place a regime to distribute the TAC for krill in area 48 in the event the krill catch exceeds the trigger level (conservation measure 51-07 (2009) and paragraph 12.60-12.61).	

Year	Scientific Advice	Decisions Made	Summary
2010	From the Scientific Committee Report.[693] The Committee recommended a TAC for *C.gunnari* in sub-area 48.3 of 2305 tonnes in 10/11 and 1535 tonnes in 11/12 (paragraph 3.99). The Committee recommended a TAC for *C.gunnari* in division 58.5.2 of 78 tonnes (paragraph 3.104). The Committee recommended a new precautionary catch limit for krill of 5.61 million tonnes in area 48 (paragraph 3.30).	From the Commission Report.[694] The Commission set a TAC for *C.gunnari* in sub-area 48.3 of 2305 tonnes (conservation measure 42-01 (2010) and paragraph 12.40). The Commission set a TAC for *C.gunnari* in division 58.5.2 of 78 tonnes (conservation measure 42-02 (2010) and paragraph 12.41). The Commission set a TAC for krill in area 48 of 5.61 million tonnes, with a trigger level of 620000 tonnes (conservation measure 51-01 (2010) and paragraph 4.29).	The Commission implemented measures that was recommended by the Committee however as in 2009 the Commission report was very unclear as to what scientific recommendations it was acting on or in the absence of scientific recommendations what it alternative basis for action was.

[693] D. Agnew, 'Report of the Twenty Ninth Meeting of the Scientific Committee for the Conservation of Antartic Marine Living Resources' (CCAMLR, 29 October 2010).
[694] D. MacKay, 'Report of the Twenty Ninth Meeting of the Commission for the Conservation of Antartic Marine Living Resources' (CCAMLR, 5 November 2010).

Year	Scientific Advice	Decisions Made	Summary
	The Committee advised the Commission that gillnets were a destructive fishing method (paragraph 6.6).	The Commission put in place an interim prohibition on gillnetting (Conservation 22-04 (2010) and paragraph 12.11).	
2011	From the Scientific Committee Report.[695] The Committee recommended a TAC for *C.gunnari* in sub-area 48.3 of 3072 tonnes in 11/12 and 2933 tonnes in12/13 (paragraph 3.62). The Committee recommended a TAC for *C.gunnari* in division 58.5.2 of 0 tonnes (with 30 tonnes for by-catch) (paragraph 3.71).	From the Commission Report.[696] The Commission set a TAC for *C.gunnari* in sub-area 48.3 of 3072 tonnes (conservation measure 42-01 (2011) and paragraph 4.31). The Commission set a TAC for *C.gunnari* in division 58.5.2 of 0 tonnes with a 30 tonnes limit for by-catch and research (conservation measure 42-02 (2011) and paragraph 4.31).	The Commission enacted the recommendations of the Committee.

695 D. Agnew, 'Report of the Thirtieth Meeting of the Scientific Committee for the Conservation of Antartic Marine Living Resources' (CCAMLR, 28 October 2011).
696 T. Løbach, 'Report of the Thirtieth Meeting of the Commission for the Conservation of Antartic Marine Living Resources' (CCAMLR, 4 November 2011).

Year	Scientific Advice	Decisions Made	Summary
	The Committee recommended a TAC for *D.eleginoides* in sub-area 48.3 of 2600 tonnes in the 11/12 and 13/14 (paragraph 3.78). The Committee recommended a TAC for *Dissostichus* spp. in sub-area 48.4 in the north 44 tonnes and in the south 33 tonnes (paragraph 3.87). The Committee recommended a TAC for *D.eleginoides* in division 58.5.2 of 2730 tonnes for the 11/12 and 13/14 seasons (paragraph 3.92).	The Commission set a TAC for *D.eleginoides* in sub-area 48.3 of 2600 tonnes in the 11/12 and 13/14 seasons. The Commission also put in place spatial limitations on where the catch could be taken (conservation measure 41-02 (2011) and paragraph 4.22). The Commission set a TAC for *Dissostichus* spp. in sub-area 48.4 of 40 tonnes in the north and 30 tonnes in the south (conservation measure 41-03 (2011) and paragraph 4.22). The Commission set a TAC for *D.eleginoides* in division 58.5.2 of 2730 tonnes with spatial limitations for both the 11/12 and the 12/13 seasons (conservation measure 41-08 (2011) and paragraph 4.22).	

Year	Scientific Advice	Decisions Made	Summary
	The Committee recommended that the fishery for crabs in sub-area 48.3 be closed (paragraph 3.113). The Committee recommended that the Commission make changes to the measures regulating bottom fishing (paragraphs 5.3 – 5.6). The Committee made a number of observations on proposals for MPAs (paragraph 5.17-5.25). The Committee recommended that there be updates to the measures mitigating sea-bird incidental mortality (paragraphs 4.9 – 4.10).	The Commission closed the crab fishery in accordance with advice from the Committee (paragraph 12.37). The Commission put in place measures to protect vulnerable ecosystems from bottom fishing (conservation measure 22-09 (2011), paragraphs 12.18-12.19). The Commission set up a framework for the creation of MPAs (conservation measures 91-04 (2011) and paragraph 12.38). The Commission updated measures to protect minimise incidental mortality of sea-birds and marine mammals (conservation measures 25-03 (2011) and paragraph 12/13).	

Year	Scientific Advice	Decisions Made	Summary
2012	From the Scientific Committee Report.[697] The Committee did not make a new assessments of for *C.gunnari* in sub-area 48.3 but did reiterate the assessment that the TAC should be 2933 tonnes from 2011 (paragraph 3.56). The Committee recommended that the catch limit for *C.gunnari* in division 58.5.2 should be 679 tonnes for 2012/2013 and 573 tonnes for 2013/2014 (paragraph 3.61). The Committee recommended a catch limit for *Dissostichus* spp. in sub-area 48.4 of 63 tonnes in the northern area (with a limit on	From the Commission Report.[698] The Commission set a TAC for *C.gunnari* in sub-area 48.3 of 2933 tonnes (conservation measure 42-01 (2012) and paragraph 7.52). The Commission set a TAC for *C.gunnari* in division 58.5.2 of 679 tonnes (conservation measure 42-02 (2012) and paragraph 7.52). The Commission did not discussed the proposed limitations for 2013/2014. The Commission set a TAC for *Dissostichus* spp. in area 48.4 of 63 tonnes in the northern area and 52 tonnes in the southern area	The Commission enacted the recommendations of the Committee. Where the Committee could not make recommendations the Commission acted on other sources of information.

697 C. Jones, 'Report of the Thirty-First Meeting of the Scientific Committee for the Conservation of Antartic Marine Living Resources' (CCAMLR, 26 October 2012).
698 T. Løbach, 'Report of the Thirty First Meeting of the Commission for the Conservation of Antartic Marine Living Resources' (CCAMLR, 1 November 2012).

Year	Scientific Advice	Decisions Made	Summary
	the species captured) and 52 tonnes in the southern area (paragraph 3.68). The Committee recommended that new habitats be added to the measures protecting vulnerable marine ecosystems (paragraphs 5.7-5.9). The Committee recommended changes to the information requirements for bottom fishing applications (paragraphs 5.13 – 5.14).	(Conservation Measure 41-03 (2012) and paragraph 7.32). The Commission updated measures protecting vulnerable marine ecosystems (Conservation Measure 22-09 (2012) and paragraph 7.14). The Commission updated measures regulating bottom fishing (Conservation Measure 22-06 (2012) and paragraph 5.55). The Commission renewed a prohibition on directed fishing of certain species (conservation measure 32-02 (2012) and paragraph 7.22). This measure was a consolidation of previous conservation measures prohibiting directed fishing rather than based on new advice.	

Year	Scientific Advice	Decisions Made	Summary
		The Commission updated measures limiting by-catch in sub-area 58.5.2 and new exploratory fisheries (conservation measures 33-02 (2012) and 33-03 (2012) and paragraphs 7.28-7.29). This measure used limits carried forward from previous years as the scientific committee did not provide new advice.	
2013	From the Scientific Committee Report.[699] The Scientific Committee recommended that the TAC for *C.gunnari* in sub-area 48.3 should be set at 4 635 tonnes for 2013/14 and 2 659 tonnes for 2014/15 (paragraph 3.80).	From the Commission Report.[700] The Commission endorsed the advice in relation to *C.gunnari* (paragraph 7.98). The Commission adopted a TAC of 4 635 tonnes in 2013/14 they did not include a 2659 in 2014/15 (table 1).	This year the Scientific Committee report was formatted very clearly, with those sections of the report that were recommendations to the Commission highlighted (paragraph 1.6 of the Scientific Committee Report). The Commission

[699] C. Jones, 'Report of the Thirty-Second Meeting of the Scientific Committee for the Conservation of Antartic Marine Living Resources' (CCAMLR, 21 October 2013).
[700] L. Dybiec, 'Report of the Thirty-Second Meeting of the Commission of the Commission for the Conservation of Antarctic Marine Living Resources' (CCAMLR, 23 October 2013).

Year	Scientific Advice	Decisions Made	Summary
	The Scientific Committee recommended that the TAC for *C.gunnari* in division 58.5.2 should be set at 1 267 tonnes for 2013/14 and a 30-tonne research and by-catch limit in 2014/15 (paragraph 3.84). The Scientific Committee recommended that the TAC for *D.eleginoides* in sub-area 48.3 should be set at 2400 tonnes for 2013/14 and 2014/15 (paragraph 3.87). The Scientific Committee recommended that the TAC for *D.eleginoides* in sub-area 48.4 should be set at 45 tonnes for 2013/14 (paragraph 3.94). The Scientific Committee recommended that the TAC for *D.mawsoni* in sub-area 48.4	The Commission endorsed the advice in relation to *C.gunnari* (paragraph 7.98). The Commission set a TAC of 1 267 tonnes for 2013/14 they did not include a 30-tonne research and by-catch limit in 2014/15 (table 1). The Commission set a TAC for *D.eleginoides* in sub-area 48.3 of 2400 tonnes in 2013/14 and 2014/15, with a by-catch limit of 120 tonnes for Macrourids and Rajids (Table 1). The Commission set a TAC for *D.eleginoides* in sub-area 48.4 of 45 tonnes with by-catch limits of 11 tonnes for Macrourids and 3.5 tonnes for Rajids (table 1). The Commission set a TAC of 24 tonnes for *D.mawsoni* in sub-area 48.4 with by-catch limits	report was not formatted with as much clarity but it did include discussion of all the recommendations of the Scientific Committee and included a greater level of detail on the discussions on conservations measures (for example paragraph 5.44).

Year	Scientific Advice	Decisions Made	Summary
	should be set at 24 tonnes for 2013/14 (paragraph 3.97).	of 11 tonnes for Macrourids and 3.5 tonnes for Rajids (table 1).	
	As no new information was available on fish stocks in division 58.5.1 (outside areas of national jurisdiction) the Scientific Committee recommended that the prohibition of directed fishing for *D.eleginoides* remain in force (paragraph 3.104).	The Commission did not discuss this advice in their report but the conservation measure remained in force.	
	The Scientific Committee recommended a TAC of 2730 tonnes for *D.eleginoides* at Heard Island (division 58.5.2), but noted that there was an increasingly unacceptable amount of uncertainty around the assessments for this stock (paragraphs 3.115 and 3.116).	The Commission endorsed the advice of the Scientific Committee that there should be a TAC of 2730 tonnes for *D.eleginoides* at Heard Island (division 58.5.2) (paragraph 5.24) and implemented this TAC (table 1).	
	There was no new information relating to fish stocks in sub-area 58.6, therefore the Scientific Committee recommended that the	The Commission agreed to carry forward the prohibition on directed fishing for *D.eleginoides*	

Year	Scientific Advice	Decisions Made	Summary
	prohibition of directed fishing for *D.eleginoides* should continue (paragraph 3.128). No new information was available on the state of fish stocks in sub-areas 58.6 and 58.7 and division 58.4.4 and therefore the Scientific Committee recommended that the prohibition of directed fishing for *D.eleginoides* should continue (paragraph 3.133). The Scientific Committee recommended that the TAC for *Dissostichus spp*. in sub-area 88.1 should be set at 3 044 tonnes for 2013/14 and 2014/15 (paragraph 3.150). The Scientific Committee recommended a series of catch limits for research fishing in research unit 882A (paragraph 3.115) but also noted that opening this area to fishing may	in areas outside national jurisdiction in sub-area 58.6 (paragraph 5.25). The Commission agreed to carry forward the prohibition on directed fishing for *D.eleginoides* in areas outside national jurisdiction in in sub-areas 58.6 and 58.7 and division 58.4.4 (paragraph 5.25). The Commission set a TAC for *Dissostichus spp*. in sub-area 88.1 of 3 044 tonnes including 43 tonnes set aside for a research survey (table 1). The Commission could not come to a consensus on how to manage the Ross Sea area (of which research unit 882A is a part) and therefore the existing catch limit of 0 tonnes remained (paragraph 5.37).	

Year	Scientific Advice	Decisions Made	Summary
	have consequences for the proposed MPA (paragraph 3.116).		
	The Scientific Committee was unable to reach consensus on recommendations for research units 882C-G so provided three options to the Commission, ranging from a catch limit of 266 tonnes, to a catch limit of 530 tonnes (paragraph 3.168).	The Commission noted that the Scientific Committee was unable to reach consensus, but had provided three options. Russia supported option 3 (the largest TAC) while New Zealand and the UK supported a more conservative approach. The Commission eventually agreed to option 2 (the medium TAC level) and specifically thanked Russia for their flexibility (paragraph 5.44).	
	The Scientific Committee endorsed 28 tonnes as a catch limit for *D.eleginoides* in sub-area 48.6 research blocks a and b (paragraph 3.192).	The Commission set a research catch limited for *D.eleginoides* in sub-area 48.6 research blocks a and b (table 1).	
	The Scientific Committee recommended that the catch limit for *D.mawsoni* in research	The Commission endorsed and adopted the advice from the Scientific Committee on catch	

Year	Scientific Advice	Decisions Made	Summary
	block 48.6d should be either 100 or 150 tonnes (paragraph 3.195). The Scientific Committee also recommended that there be a catch limit for research blocks in sub-area 48.6 of: 170 tonnes in block b, 50 tonnes in block c and 190 tonnes in block e (paragraph 3.196). The Scientific Committee recommended that a part of the TAC for *D.mawsoni* in division 58.4.1 be set aside for a research project, the research consisted of taking up to 42 tonnes in a series of four research blocks within the division (paragraph 3.199). The Scientific Committee recommended that a portion of the TAC for *D.mawsoni* in division 58.4.1 also be set aside for a Japanese/Republic of Korean research	limited. The Commission noted that there was some discrepancy between naming of the research block by the Scientific Committee and the Commission and agreed on a consistent naming protocol going forward (paragraphs 7.88-7.89 and table 1). The Commission endorsed and adopted the research catch limited of 42 in division 58.4.1 (table 1). During the meeting of the Commission the Republic of Korea withdrew its notification of intention to engage in the exploratory fishery in division 58.4.1 (paragraph 7.85). There was also separately in the report discussion of	

Year	Scientific Advice	Decisions Made	Summary
	project. The allocated TAC was split between six research blocks (paragraph 3.202).	implausible catch and effort data provided by a Korean vessel engaging in that fishery (paragraph 5.62).	
	The Scientific Committee recommended that there be a catch limit of 32 tonnes of *Dissostichus* spp. for a research project in division 58.4.3a (paragraph 3.208).	The Commission endorsed and implemented the catch limit of 32 tonnes for *Dissostichus* spp. in division 58.4.3a (table 1). The Commission also implemented a range of by-catch limits (table 1) separately France had raised concerns about the bona fides of by-catch reporting by other members in this division (paragraph 6.2).	
	The Scientific Committee the Japanese research in divisions 58.4.4a and 58.4.4b to continue in the 2014 season with a catch limit of 25 tonnes in research unit C and 35 tonnes in research unit D (paragraph 3.221).	The Commission endorsed and implemented the catch limit of 25 tonnes in research unit C and 35 tonnes in research unit D, with a total catch limit of 60 tonnes in divisions 58.4.4a and 58.4.4b (Ob and Lena Banks) (paragraph 5.61).	

Year	Scientific Advice	Decisions Made	Summary
2014	From the Scientific Committee Report.[701] The Scientific Committee recommended a TAC for *C.gunnari* in sub-area 48.3 of 2 659 tonnes for 2014/15 (paragraph 3.91). The Scientific Committee recommended a TAC in 2014/15 for *C.gunnari* in division 58.5.1 of 1490 provided no catch was taken in the remainder of the 2013/14 season (paragraph 3.95). The Scientific Committee recommended a TAC for *D.mawsoni* in sub-area 48.4 of 28 tonnes for 2014/15 (3.112). The Committee	From the Commission Report.[702] The Commission endorsed the advice of the Scientific Committee on the TAC for *C.gunnari* in sub-area 48.3 (paragraph 5.23). The Commission endorsed the advice of the Scientific Committee for *C.gunnari* in division 58.5.1 (paragraph 5.23). The Commission endorsed the advice of the Scientific Committee in relation to for *D.mawsoni* in sub-area 48.4 (paragraph 5.24).	The reports for both the Scientific Committee and the Commission were structured clearly and transparently. The recommendations of the Scientific Committee were clear and the Commission provided detailed information on the discussions that they had. The Commission endorsed and implemented the recommendations of the Scientific Committee.

701 C. Jones, 'Report of the Thirty-Third Meeting of the Scientific Committee for the Conservation of Antartic Marine Living Resources' (CCAMLR, 20-24 October 2014).
702 L. Dybiec, 'Report of the Thirty-Third Meeting of the Commission for the Conservation of Antarctic Marine Living Resources' (CCAMLR, 20-31 October 2014).

Year	Scientific Advice	Decisions Made	Summary
	recommendation of by-catch limits from previous years (paragraph 3.113).		
	The Scientific Committee recommended that the prohibition on directed fishing for *D.eleginoides* for areas outside of national jurisdiction in division 58.5.1 continue (paragraph 3.121).	The Commission decided that the prohibition on directed fishing for *D.eleginoides* for areas outside of national jurisdiction in division 58.5.1 would continue (paragraph 5.27).	
	The Scientific Committee recommended a TAC of 4 410 tonnes for *D.eleginoides* in division 58.5.2 (paragraph 3.133). Russian voiced its concern that the fishery (conducted by Australia) still used bottom trawling, which was prohibited through the rest of the CCAMLR area. Australia responded that studies had shown bottom trawling had a minimal impact in the area (paragraphs 3.131-3.132).	The Commission endorsed the advice on the Scientific Committee in relation to the TAC for *D.eleginoides* in division 58.5.2 and thanked Australia for supplying information to address the concerns raised in the Scientific Committee (paragraph 5.26).	

Year	Scientific Advice	Decisions Made	Summary
	The Scientific Committee recommended that the prohibition on directed fishing for *D.eleginoides* for areas outside of national jurisdiction within sub-area 58.6 remain in force (paragraph 3.38).	The Commission agreed to continue the prohibition on directed fishing for *D.eleginoides* for areas outside of national jurisdiction within sub-area 58.6 (paragraph 5.29).	
	As no new information was available the Scientific Committee recommended that the prohibition of directed fishing for *D.eleginoides* for areas outside of national jurisdiction in sub-areas 58.6 and 58.7 and division 58.4.4 remain in force (paragraph 3.142).	The Commission agreed to continue the prohibition on directed fishing for *D.eleginoides* for areas outside of national jurisdiction in sub-areas 58.6 and 58.7 and division 58.4.4 (paragraph 5.30).	
	The Scientific Committee recommended that the TAC from 2013 for *D.mawsoni* in sub-area 88.1 of 3044 tonnes be carried forward for 2014/15 (paragraph 3.16).	The Commission agreed to continue the TAC of 3044 tonnes for *D.mawsoni* in sub-area 88.1 (paragraph 5.38).	
	The Scientific Committee recommended catch limits of: 200 tonnes in research unit	The Commission endorsed the research catch limits recommended by the Scientific	

Year	Scientific Advice	Decisions Made	Summary
	882H and 419 tonnes in research units 882C–G for the research fishery for *Dissostichus spp.* sub-area 88.2 (paragraph 3.173).	Committee for the research fishery for *Dissostichus* spp. sub-area 88.2 (paragraph 5.38).	
	The Scientific Committee recommended research catch limits for *Dissostichus* spp. sub-area 48.6 be retained for 2014/15 (paragraph 3.187).	The Commission agreed to retain the catch limits for *Dissostichus* spp. sub-area 48.6 (paragraph 5.44).	
	The Scientific Committee recommend a catch limit for the exploratory fishery for *Dissostichus* spp. in division 58.4.4a and 58.4.4b (Ob and Lena Banks) of 25 tonnes in research block C and 35 tonnes in block D (paragraph 3.208).	The Commission endorsed the recommendations of the Scientific Committee in relation to the exploratory fishery for *Dissostichus* spp. in division 58.4.4a and 58.4.4b (paragraph 5.51).	
	The Scientific Committee made recommendations regarding requirements for night-time setting and bottle testing in	The Commission agreed to revise conservation measures to better minimise incidental mortality in accordance with the	

Year	Scientific Advice	Decisions Made	Summary
	longline fisheries in order to minimise incidental mortality (paragraph 4.4).	recommendations of the Scientific Committee (paragraph 5.69).	
2015	From the Scientific Committee Report.[703] The Scientific Committee advised the Commission that the current conservation management measure for krill were based on overall population level and that there was a need to manage krill at a smaller geographic scale in order to prevent impacts on krill predators. This arose because the krill fishery was concentrated in areas that were closer to land, the same areas relied on by land based predators (paragraphs 3.16, 3.25-3.26 and 3.29-3.31).	From the Commission Report.[704] The Commission endorsed the advice of the Scientific Committee in relation to the spatial distribution of krill catches and noted that members would continue to consider these issues (paragraph 5.11-5.13).	This year, as in 2014, the reports of both the Scientific Committee and the Commission were clearly structured. All recommendations of the Scientific Committee were considered by the Commission and the discussions on those recommendations, including dissenting views, were included.

703 C. Jones, 'Report of the Thirty-Fourth Meeting of the Scientific Committee for the Conservation of Antarctic Marine Living Resources' (CCAMLR, 19 - 23 October 2015).

704 D. Gonchar, 'Report of the Thirty-fourth Meeting of the the Commission for the Conservation of Antarctic Marine Living Resources' (CCAMLR, 19 - 20 October 2015).

Year	Scientific Advice	Decisions Made	Summary
	The Scientific Committee recommended a TAC for *C.gunnari* in sub-area 48.3 of 3 461 tonnes for 2015/16 and 2 074 tonnes for 2016/17 (paragraph 3.103).	The Commission endorsed the Scientific Committee advice for *C.gunnari* in sub-area 48.3 (paragraph 5.19).	
	The Scientific Committee recommended a TAC for *C.gunnari* in division 58.5.2 of 482 tonnes in 2015/16 and 357 tonnes in 2016/17 (paragraph 3.108).	The Commission endorsed the Scientific Committee advice for *C.gunnari* in division 58.5.2 (paragraph 5.19).	
	The Scientific Committee recommended a TAC for *D.eleginoides* in sub-area 48.4 of 47 tonnes for 2015/16 and 2016/17 (paragraph 3.116).	The Commission endorsed the advice of the Scientific Committee on the TAC for *D.eleginoides* in sub-area 48.4 (paragraph 5.20).	
	The Scientific Committee recommended a catch limit for *D.mawsoni* in sub-area 48.4 of 39 tonnes for 2015/16 (paragraph 3.124).	The Commission endorsed the advice of the Scientific Committee on the TAC for *D.mawsoni* in sub-area 48.4 (paragraph 5.21).	

Year	Scientific Advice	Decisions Made	Summary
	The Scientific Committee recommended a catch limit for *D.eleginoides* in sub-area 48.3 of 2 750 tonnes for 2015/16 and 2016/17 (paragraph 3.133).	The Commission endorsed the advice of the Scientific Committee on the TAC for *D.eleginoides* in sub-area 48.3 (paragraph 5.21).	
	The Scientific Committee recommended that the prohibition of directed fishing for *D.eleginoides* in division 58.5.1 outside areas of national jurisdiction remain in force in 2015/16 (paragraph 3.140).	The Commission agreed with the advice of the Scientific Committee to prohibit directed fishing for *D.eleginoides* in division 58.5.1 outside areas of national jurisdiction (paragraph 5.22).	
	The Scientific Committee recommended that the prohibition of directed fishing for *D.eleginoides* in sub-area 58.6 outside areas of national jurisdiction remain in force in 2015/16 (paragraph 3.145).	The Commission agreed with the advice of the Scientific Committee to prohibit directed fishing for *D.eleginoides* in sub-area 58.6 outside areas of national jurisdiction (paragraph 5.23).	
	The Scientific Committee recommended a TAC for *D.eleginoides* in division 58.5.2 of	The Commission endorsed the advice of the Scientific Committee on the TAC for *D.eleginoides* in division 58.5.2 (paragraph 5.20).	

Year	Scientific Advice	Decisions Made	Summary
	3405 tonnes for 2015/16 and 2016/17 (paragraph 3.155). The Scientific Committee recommended that the TAC for *Dissostichus* spp. in sub-area 88.1 and research units 882A–B should be set at 2 870 tonnes for 2015/16 and 2016/17 (paragraph 3.186).	The Commission endorsed the advice of the Scientific Committee in relation to the fishery for *Dissostichus* spp. in sub-area 88.1 and research units 882A–B (paragraph 5.32).	

South Pacific Regional Fisheries Management Organisation

SPRFMO entered into force in 2012 and has responsibility over a vast area of ocean although other RFMOs have responsibility for many of the commercially valuable species (Tuna and Billfish) found there.[705] The SPRFMO Convention creates both a Commission and a Scientific Committee. Each member of the SPRFMO Convention is also a member of the Commission.[706] The Commission's decisions are required to be by consensus, but where consensus cannot be reached, there is the option for decisions to be taken by a three-quarter majority of members.[707] Each member of the Commission is entitled to a representative on the Scientific Committee and it makes its recommendations by consensus, but where consensus can't be reached all views are included in its report.[708] The SPRFMO Convention at Article 18 specifically makes provision for transparency in decision making by requiring that all reports and decisions be made publically available. Sufficient time has not yet passed to properly assess the decision making of the SPRFMO and it is clear from the publically available reports that they are still working to establish themselves and to develop a workable system or reporting and apportionment of workload between the various committees. Positively, the Commission has followed the Scientific Committee's recommendations in relation to the TAC for Jack Mackerel (the only stock the Scientific Committee makes recommendations on TACs for), even where some States would prefer higher allocations. Conversely the Commission has, in the years considered, deferred or failed to discuss other recommendations (such as protections for vulnerable ecosystems, or the squid fishery). This is likely due to the young age of the Commission as it follows a similar pattern to the early years of decision making in CCAMLR.

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705 South Pacific Regional Fisheries Management Organisation, *About SPRFMO* <http://www.southpacificrfmo.org/about-the-sprfmo/>.
706 *SPRFMO Convention*, Art 7.
707 *SPRFMO Convention*, Art 16.
708 *SPRFMO Convention*, Art 10.

Table 2 - The South Pacific Regional Fisheries Management Organisation

This table summarises the recommendations of the SPRFMO Scientific Committee and with the decisions by the SPRFMO Commission (. It is not intended to include every recommendation of the Committee and every act of the Commission, but rather focuses on those decisions that consider science-based questions.

Year	Scientific Advice	Decisions Made	Summary
2013	From the Report of the First Scientific Committee Meeting.[709] The advice of the Committee was to ensure catches in 2014 for the entire Jack Mackerel range in the southeast Pacific were maintained at or below 440 kilo tonnes (page 8).	From the report of the Second Meeting of the Commission of the South Pacific Regional Fisheries Management Organisation.[710] The Commission accepted the recommendation of the Committee in relation to Jack Mackerel (paragraph 7).	The Commission adopted or enacted measures in response to all recommendations from the Committee.

[709] J. Ianelli, 'Report of the 1st Scientific Committee Meeting' (South Pacific Regional Fisheries Organisation, 27 October 2013).
[710] B. Mansfield, 'Second Meeting of the Commission of the South Pacific Regional Fisheries Management Organisation' (South Pacific Regional Fisheries Managemnet Organisation, 31 January 2014).

Year	Scientific Advice	Decisions Made	Summary
	The Committee advised that measures to protect vulnerable marine ecosystems should include spatial closures (page 11).	The Commission adopted measures for the management of bottom fishing in the Convention Area (conservation measure 2.03, paragraph 14).	
2014	From the Scientific Committee Report.[711] The Scientific Committee advised that there should be a TAC for the entire Jack Mackerel range in the southeast Pacific of at or below 460 000 tonnes (page 6 and paragraph 10.1). The Scientific Committee recommended that the Commission modify CMM 2.03 to take into account the relative impact on ecosystems of different fishing methods and practices (page 15 and paragraph 10.2).	From the Commission Report.[712] The Commission accepted the recommendation for the TAC on Jack Mackerel (paragraph 6). The Commission did not discuss this recommendation of the Scientific Committee.	The Commission accepted the recommendation of the Scientific Committee on Jack Mackerel which was the most pressing matter, but failed to discuss the other matters raised but the Scientific Committee. Both reports were not formatted for transparency.

[711] J. Ianelli, 'Report of the 2nd Scientific Committee Meeting' (South Pacific Regional Fisheries Management Organisation, 1-7 October 2014).
[712] G. Neil, 'Third Meeting of the Commission of the South Pacific Regional Fisheries Management Organisation' (South Pacific Regional Fisheries Management Organisation, 2-6 February 2015).

Year	Scientific Advice	Decisions Made	Summary
	The Scientific Committee recommended that the Commission implements a spatial management approach to benthic fisheries (page 16 and paragraph 10.2). The Scientific Committee requested that the requests the Commission to provide clearly-defined management objectives for the fisheries to facilitate the Scientific Committee to develop its research programme (page 18).	The Commission did not discuss this recommendation of the Scientific Committee. The Commission did not discuss this recommendation of the Scientific Committee.	
2015	From the Scientific Committee Report.[713] The Scientific Committee reaffirmed its recommendation that the Commission should modify the conservation measure limiting the use of fishing methods to take into account the	From the Commission Report.[714] The Commission amended the conservation measure so that it would be reviewed in 2017 but did not otherwise incorporate the Scientific Committee's recommendations (paragraph 6j).	The Commission report was very short and did not include details of discussions. The Commission accepted the recommendation in relation the TAC for Jack

713 J. Ianelli, 'Report of the 3rd Scientific Committee Meeting' (South Pacific Regional Fisheries Management Organisation, 28th September - 3rd October 2015).
714 G. Neil, 'Fourth Meeting of the Commission of the South Pacific Regional Fisheries Management Organisation' (South Pacific Regional Fisheries Management Organisation, 25-29 January 2016).

Year	Scientific Advice	Decisions Made	Summary
	relative impact on ecosystems of different fishing methods and practices (paragraph 6.3). The Scientific Committee recommended the Commission develop a scientifically robust spatial management approach for bottom fisheries using open and closed areas to minimise the need for move-on rules (paragraph 6.3). The Scientific Committee recommended the Commission should set 2016 catches limits for the entire Jack Mackerel range in the southeast Pacific at or below 460000 tonnes (paragraph 10.1). The Scientific Committee recommended that the Commission: implement monitoring and reporting procedures and develop science and management tools to ensure the long-term sustainability of the Jumbo Flying Squid stock (paragraph 10.3)	The Commission noted that the Scientific Committee report had discussed spatial managements, but did not otherwise discuss the recommendation (paragraph 6). The Commission accepted the recommendation of the Scientific Committee in relation to the TAC for Jack Mackerel (paragraph 6a). Some countries expressed the desire for an increased allocation in future years. No discussion of the recommendations relating to squid was recorded in the Commission's report.	Mackerel but deferred or did not report on discussions relating to the other recommendations of the Scientific Committee.

Year	Scientific Advice	Decisions Made	Summary
	The Scientific Committee recommended that the New Zealand proposal to conduct an exploratory fisheries for Toothfish could proceed with a catch limit of 30 tonnes per a year (paragraph 6).	The Commission adopted a management measure for exploratory fishing for Toothfish in accordance with the Scientific Council recommendation (paragraph 6f). The Commission noted the need to decide on a consistent approach to referencing of new and amended conservation measures (paragraph 6).	

The South East Atlantic Fisheries Organisation

The SEAFO Convention is relatively new, negotiations commenced in 1995, it was signed in 2001, and entered into force in 2003.[715] SEAFO has both a Commission, and a Scientific Committee.[716] The Commission is created by the SEAFO Convention and each contracting party to that Convention is entitled to have a representative on the Commission in accordance with Article 6 of that convention.[717] All substantive decisions of the Commission are taken by consensus in accordance with the rules of procedure and Article 17 of the SEAFO Convention.[718] Meetings of the Commission are open to observers in accordance with Article 8 of the SEAFO Convention and part VI of the SEAFO Rules of Procedure.[719] The Scientific Committee is created by Article 10 of the SEAFO Convention and each party to that Convention is entitled to have a representative on the committee.[720] Representatives to the Scientific Committee can be accompanied by advisors and the Scientific Committee as a collective can consult experts as required, in accordance with Article 10 of the SEAFO Convention.[721]

SEAFO has a mixed record on the implementation of conservation measures based on scientific advice. In some years the Commission enacted measures based on the scientific advice, or considered and provided reasons for not following the provided scientific advice. In other years the Commission appeared to completely ignore advice and recommendations, at least within publically available report. One problem with understanding why the Commission failed to implement conservation measures based on advice is the lack detail in SEAFO reporting in some years. In 2005, 2006, 2007 and 2009 it was very difficult to ascertain which recommendations of

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715 South East Atlantic Fisheries Organisation, *General Introduction* <http://www.seafo.org/>.
716 Ibid.
717 South East Atlantic Fisheries Organisation, *The Commission > Introduction* <http://www.seafo.org/CommIntroduction.html>.
718 Ibid.
719 Ibid.
720 South East Atlantic Fisheries Organisation, *Scientific Committee > Introduction* <http://www.seafo.org/SCIntroduction.html>.
721 Ibid.

the Scientific Committee were considered by the Commission and equally difficult to determine the advice which formed basis for conservation measures actually implemented by the Commission.[722] The lack of clarity in the structure of these reports from the Scientific Committee and Commission make it difficult to ascertain if there was consideration of scientific advice at all. In 2008 the Commission report[723] was restructured and made dramatically clearer allowing for easy comparison between scientific recommendations and conservation measures, however, the change was short lived with the 2009 report[724] returning to the previous structure. In 2008 the increased transparency was notable because in that year the Commission considered all areas of scientific advice and implemented conservation measures based on them. In 2012, 2013, 2014 and 2015 the reports of both the Scientific Committee and the Commission were structured in a way that was very clear with all recommendations and discussions included.

In cases where the Commission specifically considered, and then decided not to implement measures recommended by the Scientific Committee it was normally for policy/political reasons. For example in 2005 the Commission decided not to implement a recommended freeze on new fishing in some fisheries as this would be a bar to new entrants and discriminate between Member States.[725] In 2007, the Commission decided not to implement a closure of certain seamounts because in their view there was not enough data to substantiate the recommendation of the Scientific Committee. Also in 2007 the Commission decided not to implement a recommended ban on gillnetting as they did not want to discriminate against a particular type of fishing.[726] These

722 J. Spencer, 'The Report of the 2nd Annual Meeting of the Commission, 2005' (South East Atlantic Fisheries Organisation, 6 October 2005); J. Spencer, 'The Report of the 3nd Annual Meeting of the Commission, 2006' (South East Atlantic Fisheries Organisation, 5 October 2006); F. Tsheehama, 'The Report of the 4th Annual Meeting of the Commission, 2007' (South East Atlantic Fisheries Organisation, 8 October 2007); J. Groenhof, 'The Report of the 6th Annual Meeting of the Commission, 2009' (South East Atlantic Fisheries Organisation, 8 October 2009).

723 F. Tsheehama, 'The Report of the 5th Annual Meeting of the Commission, 2008' (South East Atlantic Fisheries Organisation, 9 October 2008).

724 Groenhof, above n 722.

725 Spencer, above n 722.

726 Tsheehama, above n 723, paras 7.1 and 7.4.

cases may be disappointing to those who wished to see more extensive conservation measures, but they demonstrate the ability of the Commission to make decisions divergent with scientific advice while explaining their reasons for doing so in a transparent manner. This is a vital attribute for decision making bodies to be able to implement measures where there is scientific uncertainty. In 2010 the Commission was able to implement conservation measures in the absence of scientific consensus, by implementing a TAC that was in between two separately advised numbers.[727] Unfortunately, in other years, 2011, 2012 and 2014, the lack of recommendations, or consensus, from the Committee led to a lack of measures being implemented by the Commission for no reason other than the lack of scientific advice.[728] This illustrates the importance of the Commission being able to implement measures based on non-scientific sources of information, particularly in fisheries management where uncertainty is a regular occurrence and therefore rigid adherence to a requirement for scientific certainty would lead to inaction. In 2015 the Scientific Committee recommended harvest control rules to improve the ability of the Commission to make decisions on TACs. While the Commission adopted these harvest control rules the Japanese delegate expressed the view that some recommendations (like those for harvest control rules) of the Scientific Committee were not based on as rigorous assessments as they should be.

[727] J. Groenhof, 'The Report of the 7th Annual Meeting of the Commission, 2010' (South East Atlantic Fisheries Organisation, 15 October 2010), para 8.8.1.

[728] O. Skagestad, 'The Report of the 8th Annual Meeting of the Commission, 2011' (South East Atlantic Fisheries Organisation, 14 October 2011);O. Skagestad, 'The Report of the 9th Annual Meeting of the Commission, 2012' (South East Atlantic Fisheries Organisation, 7 December 2012).

Table 3 - The South East Atlantic Fisheries Organisation

This table summarises the recommendations of the SEAFO Scientific Committee compared with the decisions by the SEAFO Commission, it is not intended to include every recommendation of the Committee and every act of the Commission, but rather focuses on those decisions that consider science-based questions. When detailing recommendations or decisions only those that are new are included. The SEAFO Commission first met in 2004, however, this meeting did not consider any scientific or conservation measures.

Year	Scientific Advice	Decisions Made	Summary
2005	From the Scientific Committee Report[729] The Committee recommended that fishing should not able to increase above current levels as a precautionary measure until formal advice could be provided (paragraph 8.8).	From the Commission Report[730] The Commission considered the recommendation to freeze current fishing effort but deferred any decision until 2006. The reason for this was that the Commission did not have any information on fishing intentions and only one State party had fished in the area in 2004, meaning the decision to	The Commission considered but delayed decisions on freezing total allowable catch, citing a requirement for more information on the fishing intentions of States parties and did not want to freeze the fishery to new entrants.

[729] R. Toresen, 'Report of the SEAFO Scientific Committee 2005' (South East Atlantic Fisheries Organisation, 30 September 2005).
[730] Spencer, above n 722.

Year	Scientific Advice	Decisions Made	Summary
	The Committee recommended that all members be required to supply data in the form and quality that SEAFO determines, including log books, observer reports and sampling forms (paragraph 8.9).	freeze could prevent new entry in to the fishery (paragraph 10.3). The Committee's recommendation was not to freeze the States conducting fishing, but rather the total catch. The Commission enacted conservation measure 01/05 and 02/05 which increased the information being provided to SEAFO (through Vessel Satellite Monitoring, Observers and Port State reports), but did not specifically consider or enact the committees proposals (paragraph 10.4).	The Commission set up additional monitoring but did not adopt the proposals of the Committee.
2006	From the Scientific Committee Report.[731]	From the Commission Report.[732]	The Commission adopted parts of the specific recommendations of the Scientific Committee to close the

[731] R. Toresen, 'Report of the SEAFO Scientific Committee 2006' (South East Atlantic Fisheries Organisation, 29 September 2006).
[732] Spencer, above n 722.

Year	Scientific Advice	Decisions Made	Summary
	Due to insufficient data the Committee not make specific recommendations on catch levels for species (paragraph 10.1). The Committee recommended introducing closed areas around known seamounts (paragraph 10.2). The Committee recommended that fishing pressure be reduced considerably and only allowed to expand when studies had shown it was sustainable. The Committee further recommended that a system for new and exploratory fisheries be put in place to prevent expansion of the fishery before	The Commission did not consider setting catch levels. The Commission introduced seamount closed areas on the recommendation of the Committee, however not all areas were closed (conservation measure 06/06 and paragraph 7.1). There were no conservation measures based on the recommendation to reduce fishing pressure considerably. This recommendation was not considered in the Commission's report.	sea mounts and introduced other measures to protect by-catch species without recommendation. The Commission did not act on the very broad recommendation to reduce fishing pressure (except by closing some sea mounts).

Year	Scientific Advice	Decisions Made	Summary
	sustainable limits could be set (paragraph 10.1).	The Commission adopted measures to protect sharks and prevent shark finning. This measure was not based on any recommendation from the Committee (conservation measure 04/06 and annex 6). The Commission also adopted measures to protect sea birds from incidental mortality this was not based on a specific recommendation (conservation measure 05/06 and annex 7).	

Year	Scientific Advice	Decisions Made	Summary
2007	From the Scientific Committee Report.[733] The Committee recommended a TAC for Toothfish of 260 tonnes (paragraph 8.f). The Committee recommended a TAC for Deep-sea Red Crab of 200 tonnes in sub-area B1 and 200 tonnes in the remainder of the SEAFO area (paragraph 8.g). The Committee suggested that the sea mounts that were recommended for closure in 2006, but not closed in the 2006 conservation measure should, be closed in 2007 (paragraph 8.h).	From the Commission Report.[734] The Commission set a TAC for Toothfish of 260 tonnes (conservation measure 10/07 and annex 10). The Commission set a TAC for Deep-sea Red Crab of 200 tonnes in sub-area B1 and 200 tonnes in the wider area (conservation measure 10.07 and annex 10). The recommended closure of seamount banks were discussed at length. Parties raised concerns that if all areas are closed, there is no other way that data can be obtained;	The Commission enacted TACs where recommended by the Committee. However, the Commission failed to act on the recommendation that further seamounts will be closed and based their decisions on scientific data requirements (therefore overruling the committee on a matter of science). The Commission also failed to act on the proposal to limit gillnetting and trawling based on not wanting to single out a particular type of fishing.

733 B. van Zyl, 'Report of the SEAFO Scientific Committee 2007' (South East Atlantic Fisheries Organisation, 5 October 2007).
734 Tsheehama, above n 723.

Year	Scientific Advice	Decisions Made	Summary
	The Committee recommended banning all trawling in the SEAFO area (paragraph 8.b). The Committee recommended banning the use of gill nets in the SEAFO area until measures are in place to manage net fisheries (paragraph 8.j).	therefore no conservation measures were adopted (paragraph 7.4). The Commission discussed the recommended ban on trawling and gillnetting but did not pass any conservation measures. The Commission reasoned that all types of fishing were detrimental to the environment so there was no reason to single one out, they also noted that there was no gillnetting in the area (paragraph 7.1).	
2008	From the Scientific Committee Report.[735]	From the Commission Report.[736]	The Commission adopted all the recommendations of the Committee including those relating to TACs. Both the Committee and

[735] P. Large, 'Report of the SEAFO Scientific Committee 2008' (South East Atlantic Fisheries Organisation, 3 October 2008).
[736] Tsheehama, above n 723.

Year	Scientific Advice	Decisions Made	Summary
	The Committee recommended a TAC of 100 tonnes for Orange Roughy (paragraph 8.d). The Committee recommend a TAC of 200 tonnes for Alfonsino (paragraph 8.d). The Committee recommended a TAC of 260 tonnes for Toothfish (paragraph 8.k). The Committee recommended a TAC for Deep-sea Red Crab of 200 tonnes in sub-area B1 and 200 tonnes in the remainder of the SEAFO area (paragraph 8.l). The Committee recommended that there be no directed fishing for shark species (paragraph 8.e).	The Commission set a TAC of 100 tonnes for Orange Roughy (paragraph 8.4). The Commission set a TAC of 200 tonnes for Alfonsino (paragraph 8.4). The Commission maintained the TACs for Toothfish (260 tonnes) and Deep-sea Red Crab (200 tonnes in B1 and 200 tonnes in the wider area) (paragraph 8.5). The Commission agreed with the recommendation of the Committee to ban deep-water shark directed fisheries in SEAFO CA until additional information became	Commission structured their reports to make it clear what was being recommended and which recommendations were acted on, thus significantly improving transparency.

Year	Scientific Advice	Decisions Made	Summary
		available to identify sustainable harvesting levels (paragraph 8.6). The Commission called on all parties to provide better quality and larger quantities of data, to support decision making (paragraph 8.1). The Commission put in place additional reporting requirements for bottom fisheries, this was based on a United Nations General Assembly Resolution relating to bottom fishing, not on advice from the Committee (conservation measure 12/08 and paragraph 8.9).	

Year	Scientific Advice	Decisions Made	Summary
2009	From the Scientific Committee Report.[737] The Committee recommended a reduction in TAC for Toothfish from 260 to 200 tonnes, based on a change in the CCAMLR conservation measures for that species (page 20). The Committee recommended a TAC of 50 tonnes for Orange Roughy in the SEAFO area excluding sub-area B1 (page 21). The Commission recommended closing the Orange Roughy fishery based on uncertainty over numbers in sub-area B1 (page 21).	From the Commission Report.[738] The Commission set a TAC for Toothfish of 200 tonnes (paragraph 10.2). The Commission set a TAC for Orange Roughy of 50 tonnes (paragraph 10.2). The Commission did not report that it considered the closure of the Orange Roughy fishery in sub-area 50.	The Commission adopted many of the recommendations of the Committee with minor amendment, but did not consider or report on the recommendation of the Committee to close the Orange Roughy fishery in sub-area B1. The structure of the Commission's report did not clearly show which recommendations they considered and which they did not. Additionally the Commission did not publish their conservation measures as part of their report, or in accessible format on the website.

737 P. Large, 'Report of the SEAFO Scientific Committee 2009' (South East Atlantic Fisheries Organisation, 2 October 2009).
738 Groenhof, above n 727.

Year	Scientific Advice	Decisions Made	Summary
	The Committee recommended changes to conservation measures protecting birds from incidental mortality in line with changes to CCAMLR measures (page 22). The Committee recommended changes to conservation measures protecting turtles from incidental mortality (page 35). The Committee recommended a ban on gillnets, or, if not a ban, that there should management measures to limit their impact on the marine environment (page 36).	The Commission adopted new measures based on recommendation from the Committee on incidental sea-bird mortality (paragraph 10.3). The Commission adopted new measures for sea turtles (paragraph 10.3). The Commission adopted a ban on gillnet fishing (paragraph 10.8).	
2010	From the Scientific Committee Report.[739]	From the Commission Report.[740]	The Commission enacted all recommendations of the

[739] P. Large, 'Report of the SEAFO Scientific Committee 2010' (South East Atlantic Fisheries Organisation, 9 October 2010).
[740] Groenhof, above n 727.

Year	Scientific Advice	Decisions Made	Summary
	The Committee could not agree on a recommendation for a Toothfish TAC, there for the Committee advised the Commission to set the TAC at 200 or 260 tonnes based on the minority and majority of member views (page 34). The Committee recommended that sub-area B1 be closed to Orange Roughy fishing (page 30). The Committee recommended that that the seamount closed areas in the SEAFO be revised to include additional seamounts (page 11).	The Commission set a TAC of 230 tonnes for Toothfish in-between the majority and minority views of the Committee (paragraph 8.8.1). The Commission closed sub-area B1 for Orange Roughy fishing (paragraph 8.8.3). The Commission agreed to close additional seamounts on the recommendation of the Committee (paragraph 8.8.5).	Committee. Where the Committee could not agree the Commission set a TAC in between the two separate figures provided

Year	Scientific Advice	Decisions Made	Summary
2011	From the Scientific Committee Report.[741] The Committee could not come to a consensus recommendation for a TAC for Armourhead. The Committee provided two recommendations to the Commission. The first was that there should be a TAC of 200 tonnes with in sub-area B1 and 250 tonnes in the remainder of the area. The second was that there should be no measures introduced for Armourhead at this time (page 46).	From the Commission Report.[742] The Commission could not reach a decision on Armourhead and referred the matter back to the Committee for further analysis (paragraph 7.11.1).	The Committee was unable to make consensus recommendations and the Commission was unable to adopt conservation measures. There were also very few recommendations presented this year and consequently the Commission did not adopt any new substantive measures.
2012	From the Scientific Committee Report.[743]	From the Commission Report.[744]	The Commission adopted all recommendations made by the Committee, except for that on

[741] P. Large, 'Report of the SEAFO Scientific Committee 2011' (South East Atlantic Fisheries Organisation, 7 October 2011).
[742] Skagestad, above n (2011) 728.
[743] P. Kainge, 'Report of the SEAFO Scientific Committee 2012' (South East Atlantic Fisheries Organisation, 30 November 2012).
[744] Skagestad, above n (2012) 728.

Year	Scientific Advice	Decisions Made	Summary
	The Committee recommended that the status quo remain in place for all TACs currently in force, including for Toothfish with a TAC of 230 tonnes, which was based on a recommendation of 200 tonnes (from four members) or 260 tonnes (from two members) (paragraph 24). As in 2011, Committee could not reach a consensus on Armourhead and forwarded the following split recommendations to the Commission: a TAC of 120 tonnes in sub-area B1 (supported by 4 members), a TAC of 450 tonnes (supported by 1 member) or a TAC of 525 tonnes (supported by one member) (paragraph 24).	The Commission adopted all TACs recommended by consensus and a TAC of 230 tonnes for Toothfish (paragraphs 8.2 – 8.11). The Commission could not reach a consensus on Armourhead (paragraph 8.11).	Armourhead which was not made by consensus at the Committee. The Commission's report very clearly set out all the Committee's recommendations and what the Commission did in response.

Year	Scientific Advice	Decisions Made	Summary
	The Committee recommended that by-catch of all species be counted against any relevant TAC (paragraph 24). The Committee recommended that there be changes to the measures protecting sea-birds from incidental mortality, particularly the move on rules (paragraph 24).	The Commission adopted the measures recommended for sea-bird incidental mortality (paragraph 8.12). The Commission adopted measures to ensure that by-catch was counted against relevant TACs (paragraph 8.6).	
2013	From the Scientific Committee Report.[745] The Scientific Committee recommended that Flag States and Contracting Parties forward vessel logbook data to help resolve data shortfalls (recommendation AP7).	From the Commission Report.[746] The Commission accepted the recommendations of the Scientific Committee in relation to data requirements and required Contracting Parties to submit data and vessel logbooks to the executive (paragraph 6.3.1).	The report of the Scientific Committee was structured very clearly, with all recommendations to the Commission clear. The report of the Commission was equally clear with the recommendations of the Scientific Committee set out (except where there were majority and minority views) with the

745 P. Kainge, 'Report of the SEAFO Scientific Committee' (South East Atlantic Fisheries Organization, 30th September - 11 October 2013).
746 M. Kashorte, 'The Report of the 10th Annual Meeting of the Commission' (South East Atlantic Fisheries Organization, 9 - 12 December 2013).

Year	Scientific Advice	Decisions Made	Summary
	The Scientific Committee recommended that Japan could proceed with its proposed exploratory fishery under the SEAFO guidelines (recommendation AP9). The Scientific Committee recommended that the Commission approve the new scientific observer data collection measures (recommendation AP22). The Scientific Committee could not reach consensus in regards to the TAC for Patagonian Toothfish (*D.eleginoides)* so forwarded two views to the Commission. The majority view was there should be a TAC of 230 tons for sub-area D. The minority view was that there should be	The Commission adopted the recommendation of the Scientific Committee in relation to the Japanese exploratory fishery (paragraph 6.3.3.3). The Commission adopted the recommendation of the Scientific Committee in relation to scientific observers (paragraph 6.3.4). The Commission adopted a TAC of 276 tonnes in sub-area D this was in between the majority view (230 tonnes) and minority view (381 tonnes) (paragraph 6.3.9.1).	corresponding decision of the Commission. While the Scientific Committee was unable to make recommendations for TACs based on consensus, they did forward to the Commission the majority and minority views. The disagreements in the Scientific Committee were the results on differences of opinion as to the most reliable methods to use in determining TACs, with the majority advocating for the use of catch per unit effort data (which SEAFO has a longer time series for), while the minority advocated for the use of various deviations of MSY or other modelling methods (for which SEAFO has only

Year	Scientific Advice	Decisions Made	Summary
	TAC of 381 tons for Sub-Area D (paragraph 23). The Scientific Committee could not reach consensus in regards to the TAC for Deep-sea Red Crab. All agreed that there should be an overall TAC of 400 tons but the majority view was that this should be divided as 200 tons in division B1, and 200 tons for the remainder of the SEAFO area. While the minority believed there should be a TAC of 300 tons in division B1 and 100 tons reserved for exploratory fishing (paragraph 23). The Scientific Committee could not reach consensus in regards to the TAC for Southern Boarfish/pelagic Armourhead. The majority advised that there should be a TAC of 100 tons for division B1.	The Commission adopted a TAC of 200 tons in division B1 and 200 tons for the remainder of the SEAFO area. This was in accordance the majority view (paragraph 6.3.9.2). The Commission could not come to consensus on a TAC for Southern Boarfish/pelagic Armourhead and therefore it was an open fishery. The	approximately 4 years of data to support). The Commission reported back that the Scientific Committee should work harder to achieve consensus, rather than reporting majority and minority views (paragraph 6.1). The Commission was able to enact conservation measures for a number of TACs by choosing values between the views forwarded by the Scientific Committee, or by accepting the majority view, however, in the case of Southern boarfish/pelagic Armourhead the Commission could not reach a consensus, and left the fishery open rather than closing the fishery (the precautionary approach). This showed that where there are

Year	Scientific Advice	Decisions Made	Summary
	Whereas the minority view advocated for a TAC of 450 tons for division B1 (paragraph 23). There was no new data for Alfonsino and therefore the Scientific Committee could not make a recommendation on TAC (paragraph 10.2). The Scientific Committee recommended that once the TAC for either Southern Boarfish or Alfonsino is reached, the mid-water trawl fishery should be closed (recommendation AP15).	Commission noted that Korea said it would voluntarily limit its catch to 300 tonnes (paragraph 6.3.9.3). The Commission did not discuss this, but requested an assessment of Alfonsino for the next meeting (paragraph 6.4.1) The Commission noted that this recommendation could not be implemented because no agreement on a TAC for either species could be reached (paragraph 6.3.10).	economic interests the Commission had difficulty making decisions in the absence consensus scientific advice.
2014	From the Scientific Committee Report.[747]	From the Commission Report.[748]	The reports from the Scientific Committee and Commission were

[747] P. Kainge, 'Report of the SEAFO Scientific Committee' (South East Atlantic Fisheries Organization, 29th September – 10th October 2014).
[748] M. Kashorte, 'Report of the 11th Annual Meeting of the Commission, 2014' (South East Atlantic Fisheries Organization, 01 – 05 December 2014).

Year	Scientific Advice	Decisions Made	Summary
	In response to the Commission request the Scientific Committee stated that presently no advice could be given regarding the need for fishing gear regulations (paragraph 24.5). The Scientific Committee recommended that the Japanese exploratory fishing plan could be approved with the proviso that after the 10 experimental hauls the vessel will sample a new area (paragraph 26.2). The Scientific Committee recommended TAC of 200 tonnes for the SEAFO Conservation Area, with a maximum of	The Commission approved the exploratory fishing plan with the proviso that on completion of 10 research hauls, the vessel will continue the exploratory fishing in other zones in order to cover as many representative areas as possible in the fishable zone (paragraph 6.9.2). The Commission adopted the Scientific Committee recommendations in relation to TACs for Alfonsino (paragraph 6.9.3).	both detailed and clearly formatted. The Scientific Committee was able to provide advice on all relevant matters apart from gear restrictions and for the first time developed harvest control rules (that will assist in the future to make decisions in politically charged matters). The Commission adopted the recommendations of the Scientific Committee and included detail on its discussion relating to the Scientific Committee.

Year	Scientific Advice	Decisions Made	Summary
	132 tonnes from the division B1 for Alfonsino (paragraph 26.4).		
	As there was already a TAC for Patagonian Toothfish for 2015 the Scientific Committee provided no advice on one. The Committee did, however, propose a harvest control rule for determining future TACs (paragraph 26.5).	The Commission adopted the harvest control rule proposed by the Scientific Committee (paragraph 6.9.4).	
	The Scientific Committee recommended a TAC for pelagic Armourhead of 143 tonnes (paragraph 26.9). The Committee also recommended a harvest control rule for determining future TACs.	The Commission adopted both the harvest control rule and the TAC of 143 tonnes for 2015 (paragraph 6.9.5).	
	The Scientific Committee recommended a continuation of the moratorium on fishing for Orange Roughy in division B1 and a	The Commission adopted the TACs and by-catch limit recommended by	

Year	Scientific Advice	Decisions Made	Summary
	TAC of 50 tonnes for the rest of the SEAFO Conservation Area. The Committee also recommended a limit on Orange Roughy as by-catch of 4 tonnes (recommendation 26.10). The Scientific Committee recommended a harvest control rule for Deep-sea Red Crab based on changes in Catch per Unit of Effort (paragraph 4.7 Appendix VII). The Scientific Committee recommended a monitoring and by-catch regime for directed boarfish and alfonsino fishery which includes daily cumulative catch reports (paragraph 26.12).	the Scientific Committee (paragraph 6.9.6). The Commission adopted the harvest control rule for Deep-sea Red Crab (paragraph 6.9.7). The Commission included the proposed by-catch regime in Conservation Measure 28/14 (paragraph 6.9.8)	

Year	Scientific Advice	Decisions Made	Summary
2015	From the Scientific Committee Report.[749] The Scientific Committee advised that the exploratory fishery proposed by Japan met the SEAFO requirements (paragraph 21.3). The Scientific Committee recommended that SEAFO closed areas: the Schmitt-Ott (Closure no. 9), Wüst(Closure no. 7), and Vema (Closure no. 6) seamounts remain closed (paragraph 21.5). The Scientific Committee recommended that the 'Valdivia Complex' would most likely not satisfy the vulnerable marine	From the Commission Report.[750] The Commission approved the Japanese fishery proposal (page 3, paragraph 6.11). The Commission adopted this recommendation (page 3, paragraph 6.11). The Commission adopted this recommendation. (page 4, paragraph 6.11).	The reports from the Scientific Committee and Commission were both detailed and clearly formatted. The Commission adopted the recommendations of the Scientific Committee. Some States (Japan) expressed concern that the recommendations of the Scientific Committee were in some cases based on methods that were not rigorous enough.

749 P. Kainge, 'Report of the SEAFO Scientific Committee' (South East Atlantic Fisheries Organisation, 30th September– 9th October 2015).
750 M. Kashorte, 'Report of the 12th Annual Meeting of the Commission, 2015' (South East Atlantic Fisheries Organisation, 30th November - 03 December 2015).

Year	Scientific Advice	Decisions Made	Summary
	ecosystem criteria and therefore could remain open to fishing (paragraph 21.6).		
	A research study found vulnerable marine ecosystems existed near current fishing areas and recommended that: either 1) to close to all fishing the subarea where vulnerable ecosystems were documented, or 2) to leave open these subareas to pot fishing for crabs only but close them to other gears (paragraph 21.7).	The Commission adopted the recommendation that the area be closed to all fishing gear except for pot and longline gears (i.e. option 2 proposed by the Scientific Committee (page 4 paragraph 6.11).	
	The Scientific Committee recommended a TAC of 264 tonnes for Patagonian Toothfish in Sub-Area D and 0 tonnes for the remainder of the SEAFO area (paragraph 21.9).	The Commission adopted the TAC recommendations, however, Japan pointed out the importance of stock assessments to properly determine TACs (page 5, paragraph 6.11).	
	The Scientific Committee recommended a Deep-Sea Red Crab TAC of 190 tonnes		

Year	Scientific Advice	Decisions Made	Summary
	for division B1 and 200 tonnes for the remainder SEAFO area (paragraph 21.9).		

The General Fisheries Commission for the Mediterranean

The GFCM was established in 1949 and has 23 Member States, plus the European Union. The GFCM Agreement has undergone considerable reform since creation with the latest changes occurring in 2004.[751] The current structure includes a decision making Commission with the ability to implement conservation measures in accordance with Article V of the GFCM Agreement membership in the Commission is open to all members of the UN who accede to the Agreement, and all members of the Commission are entitled to one vote in its meetings.[752] Decisions on conservation measures are taken by a two-thirds majority, provided that a majority of members are present to make a quorum.[753] There is also a dispute mechanism which allows members to opt out of a conservation measure by registering an objection within 120 days of the measure passing.[754] Importantly there is no provision within the GFCM Agreement text for a scientific advisory body. Scientific advice is provided to the Commission by the Scientific Advisory Committee (established by Commission resolution), the Committee meets as required and provides "independent advice on the technical and scientific bases for decisions concerning fisheries conservation and management, including biological, social and economic aspects" of GFCM activities.[755] Membership in the Committee is open to all members of the Commission and voting in the Committee is also governed by the same rules as the Commission.[756] In both the Commission and the Committee observers are permitted with the permission of the Commission.[757]

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[751] General Fisheries Commission for the Mediterranean, *About GFCM* <http://www.gfcm.org/gfcm/about/en>.
[752] Ibid.
[753] *GFCM Agreement* (as amended until 1997), Arts II and V.
[754] *GFCM Agreement* (as amended until 1997), Art V.
[755] General Fisheries Commission for the Mediterranean, above n 751.
[756]*Rules of procedure of the General Fisheries Commission for the Mediterranean,* last amended at the 39th GFCM Commission Meeting (25-29 May 2015), available at http://www.fao.org/3/a-ax822e.pdf, Rule IX.
[757]Ibid, Rule XII

The GFCM Agreement has a range of features that would appear conducive to effective decision making, including a specific reference to consideration of economic and social factors[758] and the ability to make decisions with a two-third majority, rather than a requirement for consensus.[759] However, GFCM has a poor record of implementing recommendations of the Committee as binding conservation measures. In each of the years reviewed (2004-2014) the GFCM Scientific Advisory Committee made recommendations on reducing fishing mortality, closed areas and gear restrictions. In 2010 the Scientific Advisory Committee expressly decided that it would provide more advice on specific measures (including specific TACs) rather than simply recommending the reduction in general fisheries mortality. In 2005, 2006 2007, 2008, 2010 and 2011 the Commission failed to take a single recommendation of the Scientific Advisory Committee forward as a binding measure. While in 2007 and 2011 recommendations of the Committee were implemented only as non-binding measures on and in 2005, 2006, 2009 and 2011 the Commission implemented conservation measures that were not based on recommendations of the Scientific Advisory Committee. The reports and work of the Scientific Advisory Committee improved over the time series reviewed and in 2012, 2013 and 2014 they provided clear recommendations on all exploited fish stocks referred to it, highlighting the status of the stock and the amount reduction in mortality required to ensure the stock was sustainable. Yet, in the face of this clear advice, the GFCM failed to enact a single reduction in mortality.

It is difficult to determine why there are so few of the Scientific Advisory Committee's recommendations that are implemented as binding conservation measures. This problem has even been acknowledged by the Scientific Committee itself, in 2012 it "noted that several items of management advice proposed during [its] thirteenth session were not followed by concrete actions

758 *GFCM Agreement* (as amended until 1997), Art III, (1) (c) and (2).
759 *GFCM Agreement* (as amended until 1997), Art V.

by the Commission" and it "stressed the importance for a real improvement of the decision-making mechanism to overcome this gap".[760]

The GFCM does not have a significantly larger membership than other RFMOs (it is similar to CCAMLR) and it does not require consensus decision making as other RFMOs do. But, there are several issues that may contribute to the difficulties faced by GFCM. In the GFCM Commission reports (up to the report for 2011) the recommendations of the Scientific Advisory Committee are not specifically discussed, except in those cases (such as 2009) where they form the basis for a conservation measure. The adopted structure for reporting does not provide transparency as there is nothing included in respect of non-accepted scientific advice.

It appears that in many cases the problem is that unlike other RFMOs the Scientific Advisory Committee does not propose specific conservation measures and is indeed discouraged from providing advice that is too specific. Instead it is left to Member States to propose conservation measures and there is a strong bias for national action rather than an RFMO-wide allowable catch that is divided among nations. This emphasis on national action has resulted in a preference for recommendations as opposed to binding measures. There is also the possibility that the current timing of meetings does not assist because in 2014 the European Union delegate expressed the wish that recommendations of the Scientific Advisory Committee be provided earlier so that individual Member States might have the time to develop recommendations based on them.

It is perhaps also the case that the heavily exploited fisheries of the Mediterranean and the complex jurisdiction framework at play in that region cause impediments to decision making. However, without transparent reporting from the Commission this proposition is merely speculative. Of course the lack of reporting on specific scientific advice could itself contribute to the lack of conservation measures based on that advice; because if not all consideration of advice is reported

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760 The Food and Agriculture Organization, 'Report of the fourteenth session of the Scientific Advisory Committee' (General Fisheries Commission For the Mediterranean, 20 - 24 February 2012), para 8.

on it is difficult to hold to account GFCM in respect of its adherence to Article III (2) of the GFCM Agreement which requires consideration of the best scientific evidence available.

In 2012 and 2013 the Commission reports indicated that many States and the GFCM Secretariat were in part waiting for the proposed amendments to the GFCM to improve the ability of the Commission to adopt conservation measures (especially multi-annual fishery plans). In 2014 the amendments to the GFCM Agreement were adopted by the Commission. These amendments included a revision of the aim to be "to ensure the conservation and sustainable use, at biological, social, economic and environmental level, of living marine resources, as well as the sustainable development of aquaculture in the Area of Application."[761] Additionally the GFCM Agreement was updated to specify specific tasks for the Commission such as: the adoption of management measures aimed at ensuring the long-term sustainability of fishing activities, the adoption of measures to prevent over fishing, the adoption of management measures based on the best scientific evidence taking into account relevant economic and social factors applying the precautionary approach and to promote transparency in decision-making processes and other activities.[762] Article 8 of the amended Agreement was revised to deal specifically with the role of the Commission in adopting managing measures for living marine resources. The revised Article 8 was very specific, including guidance to the Commission to: minimise the impact of fishing activities on marine living resources, adopt multi-annual management planes to ensure stocks are maintained above levels that can produce MSY and to establish fisheries restricted areas.[763] Most importantly Article 14 of the amended Agreement was updated to specifically require that Member States transpose the management measures adopted by the Commission into domestic law, giving the measures adopted legal force.[764] Given that the specific aim of these amendments is to improve

[761] The Food and Agriculture Organization, 'Report of the thirty-eighth session' (General Fisheries Commission for the Mediterranean, 19-24 May 2014), Appendix E.
[762] Ibid, Appendix E.
[763] Ibid, Appendix E.
[764] Ibid, Appendix E.

the ability of GFCM to adopt management measures (and thus improve the status of the fish stocks under their management), it would be useful to compare decision-making within GFCM before and after the amendments. Unfortunately there is yet no sufficient decision-making examples (post the amendments) for the analysis to be undertaken in this thesis. Given that the amendments both specifically enunciate the tasks of the Commission and improve the transparency of decision making in the GFCM it would be expected (based on current best practice for RFMO decision making) that the Commission will, in the future, be more successful at adopting meaningful management measures based on the advice of the Scientific Advisory Committee.

Table 4 - The General Fisheries Commission for the Mediterranean

This table compares the recommendations of the GFCM Scientific Advisory Committee (the Committee) with the decisions made by the GFCM (the Commission), it is not intended to include every recommendation of the Committee and every act of the Commission, but rather focuses on those decisions which have a requirement for scientific advice. When detailing recommendations or decisions only those that are new are included. The analysis begins at 2005 as this was the year the current Agreement (including amendments) came into force. For some years, the GFCM meeting cycle was such that the meeting of the Committee occurred in one year, with the recommendations considered by the Commission the following year. In later years the meetings are held concurrently or in short succession. The years below refer to the year of the final Commission report, with the Committee report falling one year earlier in many cases.

Year	Scientific Advice	Decisions Made	Summary
2005	From the Report of the Scientific Advisory Committee.[765] The Committee recommended not increasing the fishing effort for Striped Mullet in area 05 (paragraph 71).	From the Report of the General Fisheries Commission.[766] This recommendation was not discussed by the Commission.	At paragraph 62 the Commission endorsed the advice of the Committee. The Commission did not specifically report on individual recommendations

765 The Food and Agriculture Organization, 'Report of the seventh session of the Scientific Advisory Committee' (General Fisheries Commission for the Mediterranean, 22 October 2004).
766 The Food and Agriculture Organization, 'Report of the twenty-ninth session' (General Fisheries Commission for the Mediterranean, 25 February 2005).

Year	Scientific Advice	Decisions Made	Summary
	The Committee recommended not increasing the fishing effort for Blue and Red Shrimp in areas 01, 05 and 06; Giant Red Shrimp in area 11; Red Mullet and Bluefish in area 14 (paragraph 71). The Committee recommended that fishing effort for Sardine and Anchovy not be allowed to increase (paragraph 71). The Committee recommended greater protection in coastal areas closed to Red Mullet fishing (paragraph 71). The Committee recommended banning the capture of Sardines in lagoons and other nursery areas and also a closed season of	This recommendation was not discussed by the Commission. This recommendation was not discussed by the Commission. This recommendation was not discussed by the Commission. This recommendation was not discussed by the Commission.	or how they were implemented. The Commission did not implement any of the recommendations relating to the constraint of fishing effort. Article V of the GFCM Agreement does allow for conservation measures to be made.

Year	Scientific Advice	Decisions Made	Summary
	one (1) month to protect spawning stocks (paragraph 71).		
	The Committee recommended that fishing should not be allowed to expand in deep water (greater than 1000m) areas (paragraph 80).	The Commission prohibited the use of towed dredges and trawl nets at depths greater than 1000m (GFCM/2005/1 paragraph 2).	
	The Committee recommended reducing the mesh size for the Hake fishery to 40mm square (paragraph 71).	The Commission required that members use a mesh size not less than 40mm for demersal trawl fisheries (GFCM/2005/1 paragraph 1).	
	The Committee recommended that a minimum size of 11 cm be put in place for the Anchovy fishery (paragraph 71).	This recommendation was not discussed by the Commission.	

Year	Scientific Advice	Decisions Made	Summary
2006	From the Report of the Scientific Advisory Committee.[767] The Committee recommended not increasing the fishing effort for Blue and Red Shrimp in areas 05 and 06 (paragraph 77). The Committee recommended a reduction in fishing effort for Red Mullet in area 06 (paragraph 77). The Committee recommended that fishing effort for Striped Mullet in area 05 not be increased (paragraph 77).	From the Report of the General Fisheries Commission.[768] The Commission decided to develop a management programme to limit effort for fisheries of Hake, Blue and Red Shrimp, Red Mullet, Striped Mullet, Red Shrimp and Norway Lobster (GFCM/2006/1).	The Commission report did not refer to individual recommendations of the Committee but simply described the report given to the Commission by the chairperson of the Committee. The Commission did not specifically report on individual recommendations or how they were implemented. The Commission did not implement any of the recommendations relating to the constraint of fishing effort.

[767] The Food and Agriculture Organization, 'Report of the eighth session of the Scientific Advisory Committee' (General Fisheries Commission for the Mediterranean 28 October 2005).
[768] The Food and Agriculture Organization, 'Report of the thirtieth session' (General Fisheries Commission for the Mediterranean, 27 January 2006).

Year	Scientific Advice	Decisions Made	Summary
	The Committee, found that Hake was overexploited and in area 22 recommended that fishing effort not increase (paragraph 77).		
	The Committee recommended that fishing effort for Anchovy should not be increased in areas 01 and 06 (paragraph 78).	This recommendation was not discussed by the Commission.	
	The Committee recommended that fishing effort for Sardine not be increased in areas 01, 03 and 06 (paragraph 78).	This recommendation was not discussed by the Commission.	
	The Committee recommended that the closed period for fisheries in area 22 should be moved to better align with the Anchovy or Sardine recruitment period (paragraph 78).	This recommendation was not discussed by the Commission.	

Year	Scientific Advice	Decisions Made	Summary
	The Committee recommended a closed period for Sardine in fishing area 03 (paragraph 78).	This recommendation was not discussed by the Commission.	
	The Committee recommended a 40mm mesh size requirement for Red Mullet in area 06 (paragraph 77).	This recommendation was not discussed by the Commission.	
	The Committee recommended 40mm square mesh size for Hake in areas 05, 06 and 07 (paragraph 77).	This recommendation was not discussed by the Commission.	
	The Committee recommended a minimum catch size for Sardine in area 06 of 13cm (paragraph 78).	This recommendation was not discussed by the Commission.	
	The Committee recommended limits on the use of fish-aggregating devices for dolphin fish (recommendations were limited after disagreement from Tunisia) (paragraph 78).	The Commission put in place a closed season for dolphin fish fish-aggregating devices (GFCM/2006/2).	

Year	Scientific Advice	Decisions Made	Summary
		The Commission put in place protected deep-sea areas (GFCM/2006/2). This was based on recommendations of the Committee in previous years.	
2007	From the Report of the Scientific Advisory Committee.[769] The Committee recommended a 30% reduction in fishing effort for Red Shrimp in area 05, though found this could be achieved through increasing the mesh size (Appendix F).	From the Report of the General Fisheries Commission.[770] The Commission did not discuss this recommendation.	The Commission failed to address the recommendations of the Committee, the one recommendation that was actioned (40mm mesh size) was done so only on a voluntary basis. There is no explanation or consideration of the reasons for not accepting recommendations in the Commission report.

769 The Food and Agriculture Organization, 'Report of the ninth session of the Scientific Advisory Committee' (General Fisheries Commission for the Mediterranean, 27 October 2006).

770 The Food and Agriculture Organization, 'Report of the thirty-first session' (General Fisheries Commission for the Mediterranean, 12 January 2007).

Year	Scientific Advice	Decisions Made	Summary
	The Committee recommended no increase to fishing effort for striped Red Mullet in area 05 (Appendix F).	The Commission did not discuss this recommendation.	
	The Committee recommended reduction of 20% in the fishing effort for Red Mullet in area 06 (Appendix F).	The Commission did not discuss this recommendation.	
	For Hake, the Committee recommended a: reduction of 20% fishing effort in area five, a reduction of 50% fishing effort in area 06 and a reduction of fishing effort in area 07 (Appendix F).	The Commission did not discuss this recommendation.	
	The Committee recommended closed seasons for gillnet and long-line fisheries for Hake in areas 06 and 07 (Appendix F).	The Commission did not discuss this recommendation.	

Year	Scientific Advice	Decisions Made	Summary
	The Committee again recommended moving the closed season for Anchovy in area 22 to Autumn or Spring (Appendix F). The Committee recommended the use of square mesh for the Red Mullet fishery in area 06 (Appendix F). The Committee again recommended use of 40mm square mesh for Hake in areas 05 and 06 (Appendix F).	The Commission did not discuss this recommendation. The Commission did not discuss this recommendation. The Commission implemented a 40mm square mesh size for all demersal fisheries on a voluntary basis (GFCM/31/2007/3).	
2008	From the Report of the Scientific Advisory Committee.[771]	From the Report of the General Fisheries Commission.[772]	The Commission passed no resolutions based on the recommendations of the Committee. The Commission report did not address the

[771] The Food and Agriculture Organization, 'Report of the tenth session of the Scientific Advisory Committee' (General Fisheries Commission for the Mediterranean, 26 October 2007).
[772] The Food and Agriculture Organization, 'Report of the thirty-second session' (General Fisheries Commission for the Mediterranean, 29 February 2008).

Year	Scientific Advice	Decisions Made	Summary
	The Committee recommended a reduction in fishing effort of 20% for Hake in areas 05 and 06 (paragraph 33).	The Commission noted its continual reliance on stock by stock assessments, but reiterated the need for a fleet based management approach (paragraph 15).	recommendations of the Committee.
	The Committee recommended a reduction in fishing effort of 10% for Red Shrimp in area 06 (paragraph 33).	The Commission did not discuss this recommendation.	
	The Committee recommended a reduction in fishing effort for Red Coral in area 06 (paragraph 33).	The Commission did not discuss this recommendation.	
	The Committee recommended a closure between 15 June and 31 August for the Red Coral fishery in area 06 (paragraph 33).	The Commission did not discuss this recommendation.	
	The Committee again recommended moving the closed season for Anchovy	The Commission did not discuss this recommendation.	

Year	Scientific Advice	Decisions Made	Summary
	fisheries and Sardine fisheries in areas 21 and 22 (paragraph 33). The Committee recommended the use of 40mm square mesh for Hake and Striped Mullet in area 05 and for Hake and Red Shrimp in area 06 (paragraph 33).	The Commission did not discuss this recommendation.	
2009	From the Report of the Scientific Advisory Committee.[773] The Committee recommended a reduction for fishing effort for Hake in area 06 (paragraph 46, table 1).	From the Report of the General Fisheries Commission.[774] The Commission did not discuss this recommendation.	The Commission adopted two measures the 10% reduction of fishing effort and a requirement for a 40mm square mesh size, both based on recommendations from the Committee. The Commission did not adopt many other recommendations

[773] The Food and Agriculture Organization, 'Report of the eleventh session of the Scientific Advisory Committee' (General Fisheries Commission for the Mediterranean, 5 December 2008).
[774] The Food and Agriculture Organization, 'Report of the thirty-third session' (General Fisheries Commission for the Mediterranean, 27 March 2009).

Year	Scientific Advice	Decisions Made	Summary
	The Committee recommended a reduction in fishing effort of 20% for Hake in area 07 (paragraph 46, table 1). The Committee recommended a reduction of 80-90% fishing mortality for Hake in area 09 and 40% in areas 15 and 16 (paragraph 46, table 1). The Committee recommended a reduction of fishing effort of 30% for Deep-water Rose Shrimp in area 16 (paragraph 46, table 1). The Committee recommended a reduction in fishing effort of 10%-50% in the sole fishery for area 17 (paragraph 46, table 1).	The Commission prevented an increase in fishing effort in area 07 for all demersal stocks (GFCM/33/2009/1). The Commission did not discuss this recommendation. The Commission resolved to reduce fishing bottom fishing effort by 10% across the whole GFCM area but as a resolution this was not binding under Article V of the GFCM Agreement. (RES/GFCM/33/2009/1). The Commission did not discuss this recommendation.	of the committee, including larger reductions in fishing effort or mortality recommended for particular species. While the Commission report identifies discussions on recommendations they did implement it does not mention recommendations that were not implemented or discussed.

Year	Scientific Advice	Decisions Made	Summary
	The Committee recommended a reduction of fishing effort for all demersal fisheries of 10 % (paragraph 44(i)).	The Commission discussed a proposal to freeze fishing capacity but no consensus could be reached (paragraph 87).	
	The Committee recommended a reduction in fishing effort for Anchovy in areas 01, 06 and 16 (paragraph 46, table 2).	The Commission did not discuss this recommendation.	
	The Committee recommended a marine protected area for Hake spawning grounds in area 06 (paragraph 46, table 1).	The Commission did not discuss this recommendation.	
	The Committee recommended a closed season for Hake in area 06 (paragraph 46, table 1).	The Commission did not discuss this recommendation.	
	The Committee recommended closed areas and seasons for the Hake fishery in area 07 (paragraph 46, table 1).	The Commission did not discuss this recommendation.	

Year	Scientific Advice	Decisions Made	Summary
	The Committee recommended closed seasons and areas for the sole fishery in area 17 (paragraph 46, table 1). The Committee recommended a closed season of 45 for Sardines in area 17 (paragraph 46, table 2).	The Commission did not discuss this recommendation. The Commission did not discuss this recommendation. The Commission adopted a minimum 40mm square mesh size or 50mm diamond mesh size for the GFCM area (GFCM/33/2009/2). This was based on previous year's recommendations of the Committee.	
2010	From the Report of the Scientific Advisory Committee.[775]	From the Report of the General Fisheries Commission.[776]	As in previous meetings, the Commission did not address any of the advice from the Committee relating to the

[775] The Food and Agriculture Organization, 'Report of the twelfth session of the Scientific Advisory Committee' (General Fisheries Commission for the Mediterranean, 29 January 2010).
[776] The Food and Agriculture Organization, 'Report of the thirty-forth session' (General Fisheries Commission for the Mediterranean, 17 April 2010).

Year	Scientific Advice	Decisions Made	Summary
	The Committee recommended a reduction in mortality for Hake of: 60% in area 03, 40% in area 09 and 61% in area 26 (paragraph 74, table 1).	This recommendation was not discussed by the Commission.	reduction in fishing mortality, except to indicate that the Committee advised that the resolution reducing mortality by 10% should be made mandatory. The Commission only reported on measures they implemented, that did not report on advice received but not considered.
	The Committee recommended a reduction in mortality for Deep-water Rose Shrimp of 33%-66% in in area 03 (paragraph 74, table 1).	This recommendation was not discussed by the Commission.	
	The Committee recommended a reduction in mortality of 64% for Sea Bream in area 03 (paragraph 74, table 1).	This recommendation was not discussed by the Commission.	
	The Committee recommended a reduction in mortality for Red Mullet of: 76% in area 03, 30% in area 09, 30% in area 15 and 61% in area 26 (paragraph 74, table 1).	This recommendation was not discussed by the Commission.	

Year	Scientific Advice	Decisions Made	Summary
	The Committee recommended a reduction in mortality of 30% for Red Shrimp in areas 15 and 16 (paragraph 74, table 1).	This recommendation was not discussed by the Commission.	
	The Committee recommended reducing the mortality by up to 79% for lobster in area 17 (paragraph 74, table 1).	This recommendation was not discussed by the Commission.	
	The Committee recommended reducing the mortality for Sole in area 17 by 86% (paragraph 74, table 1).	This recommendation was not discussed by the Commission.	
	The Committee found that both Anchovy and Sardine were overexploited in areas 1 and 6 but could not provide advice due to the lack of a reference point (paragraph 75, table 2).	This recommendation was not discussed by the Commission.	
	The Committee recommended implementing a 40mm square mesh size for	This recommendation was not discussed by the Commission.	

Year	Scientific Advice	Decisions Made	Summary
	trawl fisheries for Hake in area 7 (paragraph 74, table 1). The Committee indicated that they would in future move from advising a general reduction in fishing mortality or capacity to recommendations on specific measures that could achieve this in order to be more useful to the Commission (paragraph 72).	The Commission put in place a recommendation designed to facilitate the management of capacity in the future, by setting up a system to track fishing capacity by nation (GFCM/34/2010/2).	
2011	From the Report of the Scientific Advisory Committee.[777]	From the Report of the General Fisheries Commission.[778]	The Commission enacted some measures on by-catch, most measures were, however, non-prescriptive. Once again the Commission

[777] The Food and Agriculture Organization, 'Report of the thirteenth session of the Scientific Advisory Committee' (General Fisheries Commission for the Mediterranean, 11 February 2011).
[778] The Food and Agriculture Organization, 'Report of the thirty-fifth session' (General Fisheries Commission for the Mediterranean, 14 May 2011).

Year	Scientific Advice	Decisions Made	Summary
	The Committee recommended reducing fishing mortality for red Sea Bream in areas 01 and 03 (paragraph 63, table 1). The Committee recommended reducing the mortality of Deep-water Rose Shrimp by 60% - 80% (paragraph 63, table 1). The Committee recommended reducing the mortality of Hake in area 05 by 30%-50% (paragraph 63, table 1). The Committee recommended reducing the mortality of red Striped Mullet in area 05 by 30%-50% (paragraph 63, table 1). The Committee recommended reducing the mortality of Red Mullet in area 05 by 40%-	The Commission did not discuss this recommendation. The Commission did not discuss this recommendation. The Commission did not discuss this recommendation. The Commission did not discuss this recommendation. The Commission did not discuss this recommendation.	did not make any recommendations to reduce effort specifically based on the recommendations of the Committee and failed to report on their consideration of them.

Year	Scientific Advice	Decisions Made	Summary
	60%, area 06 by 70%, area 07 by 60%-70% (paragraph 63, table 1).		
	The Committee recommended reducing the fishing mortality of lobsters in area 05 by 20%-30% and area 06 by 70% (paragraph 63, table 1).	The Commission did not discuss this recommendation.	
	The Committee recommended reducing the effort on Hake in area 07 by 70% and 40% -80% in area 09 (paragraph 63, table 1).	The Commission did not discuss this recommendation.	
	The Committee recommended a reduction in the mortality of Sole in area 17 of 50%-80% and 40%-60% in area 26 (paragraph 63, table 1).	The Commission did not discuss this recommendation.	
	The Committee recommended a substantial reduction mortality for the Sardine fishery	The Commission did not discuss this recommendation.	

Year	Scientific Advice	Decisions Made	Summary
	in area 06 and area 07 (paragraph 63, table 2).		
	The Committee recommended a substantial reduction mortality for the Anchovy fishery for area 07 (paragraph 63, table 2).	The Commission did not discuss this recommendation.	
	The Committee recommended an extended closed season for Hake in area 07 (paragraph 63, table 1).	The Commission did not discuss this recommendation.	
	The Committee recommended measures to limit by-catch of Monk Seal, sea-birds and turtles (paragraph 49).	The Commission adopted measures aimed at investigating measures to minimise incidental sea-bird bycatch (GFCM/35/2011/3).	
		The Commission adopted measures aimed at reducing by-catch of turtles (GFCM/35/2011/4).	

Year	Scientific Advice	Decisions Made	Summary
		The Commission adopted measures aimed at reducing by-catch of Monk Seals (GFCM/35/2011/5).	
2012	From the Report of the Scientific Advisory Committee.[779] For *M.merluccius* in GSA 01 the Scientific Advisory Committee recommended a dramatic (80%) reduction in the fishing capacity and increased enforcement of mesh size and gear restrictions (Line 1, Table 1). The current fishing mortality was six times the reference point limit. For *M.merluccius* in GSA 05 the Scientific Advisory Committee recommended a reduction of fishing effort and an improvement of the selection pattern in the	From the Report of the General Fisheries Commission.[780] The Commission discussed all recommendations recommendation in general (reference to all recommendations on fish stocks), but not specifically. The Commission did not implement any management resolutions relating to any of the recommendations of the Scientific Advisory Committee, with the exception of a resolution on Red Coral, proposed by the EU.	(Note: this year the report of the Scientific Committee began to use scientific rather than common names in its report. They also started referring to 'areas' with the term general statistical area or GSA). This year the report of the Scientific Advisory Council was clearly formatted with all of the recommendations to

[779] The Food and Agriculture Organization, above n 761.
[780] The Food and Agriculture Organization, 'Report of the thirty-sixth session' (General Fisheries Commission for the Mediterranean, 14-19 May 2012).

Year	Scientific Advice	Decisions Made	Summary
	fishery (Line 2, Table 1). The current fishing mortality was six times the reference point limit. For *M.surmuletus* in GSA 05 the Scientific Advisory Committee recommended a reduction of fishing effort and an improvement of the fisheries selection pattern (Line 3, Table 1). For *A.antennatus* in GSA 05 the Scientific Advisory Committee recommended a decrease in fishing mortality through complementary measures, such as temporal closures (Line 4, Table 1). For *M.barbatus* in GSA 06 the Scientific Advisory Committee recommended a reduction in fishing mortality of 70% and increased surveillance in some areas to		the Commission laid out in a table. Many of the recommendations were simply to reduce fishing mortality or effort and did not include the recommended level of fishing mortality, even so, on some occasions members expressed a view that the recommendations should be more general. The EU in particular expressed the view that for the scientific committee to recommend specific management measures (such as a specific percentage reduction in mortality) was to exceed its competence (paragraph 18 of the Commission Report), this

Year	Scientific Advice	Decisions Made	Summary
	reduce the catch of small individuals under the minimum regulated size (Line 5, Table 1). For *A.antennatus* in GSA 06 the Scientific Advisory Committee recommended a reduction in fishing mortality by 72%, using a reduction in fishing capacity and the use of closed areas to protect nursery areas (Line 6, Table 1). For *P.longirostris* in GSA 06 the Scientific Advisory Committee recommended a reduction in fishing mortality by 70% (Line 7, Table 1). For *M.merluccius* in GSA 07 the Scientific Advisory Committee recommended a reduction in the growth of overfishing using: improved selectivity, closed nursery		is surprising as in most other RFMOs (in which the EU is a member) the scientific advisor makes very specific recommendations include TACs with actual tonnages. Several interesting points of discussion relating to the work of the Scientific Advisory Committee were raised in the Commission's report. First the EU suggested that rather than adopting urgent measures to reduce fishing mortality, the Scientific Advisory Committee should focus on longer term multi-year plans (paragraph 61, Commission Report). Additionally, Tunisia and Egypt

Year	Scientific Advice	Decisions Made	Summary
	areas, reducing fishing capacity, reducing fishing effort, reducing effort for specific gear (long lines and gillnets) and the freezing of effort in the fishery restricted zone (Line 8, Table 1). For *M.barbatus* in GSA 07 the Scientific Advisory Committee recommended a reduction in fishing mortality (it was double the target reference point) (Line 9, Table 1). For *M.merluccius* in GSA 09 the Scientific Advisory Committee recommended a reduction in fishing mortality (it was ten times the target reference point) (Line 10, Table 1). For *M.barbatus* in GSA 09 the Scientific Advisory Committee recommended a reduction of fishing mortality (current		stated that they had problems with how to implement recommendations to reduce mortality and preferred easier to implement measures such as closed areas (paragraph 77, Commission Report). The Commission reported on discussing all the measures proposed by the Scientific Advisory Committee, with many members unsure of how to implement a specific reduction in mortality. Following the discussion the report noted the thanks of the Commission for the detailed work of the Committee. Despite that thanks the

Year	Scientific Advice	Decisions Made	Summary
	mortality was above MSY) (Line 11, Table 1). For *M.surmuletus* in GSA 09 the Scientific Advisory Committee recommended a reduction in fishing mortality (current mortality twice the target reference point) (Line 12, Table 1). For *G.melastomus* in GSA 09 the Scientific Advisory Committee recommended a reduction in fishing mortality and a reduction of fishing in areas where juveniles were concentrated (Line 13, Table 1). For *A.antennatus* in GSA 09 the Scientific Advisory Committee recommended a reduction in fishing mortality (current mortality twice the target reference point) (Line 14, Table 1)		Commission failed to implement any measures to reduce fishing mortality as recommended by the Committee, except in relation to Red Coral (paragraphs 59-80, Commission Report). The problems appear not to be of transparency (the report notes some NGO observers were present and urged the Commission to adopt measures relating to protect fish stocks) or of scientific advice (as there was clearly provided specific recommendations) but rather a lack of political ability to make cuts to fisheries in the face of socio-economic pressure

Year	Scientific Advice	Decisions Made	Summary
	For *N.norvegicus* in GSA 09 the Scientific Advisory Committee recommended a reduction in fishing mortality (Line 15, Table 1). For *P.longirostris* in GSA 09 the Scientific Advisory Committee recommended that the stock was sustainably exploited and current fishing levels could continue (Line 16, Table 1). For *S.sphyraena* in GSAs 12/13 the Scientific Advisory Committee recommended that fishing mortality be reduced by 40% in the northern sector and 60% in the eastern sector (Line 17, Table 1). For *P.longirostris* in GSAs 12-16 the Scientific Advisory Committee		(paragraphs 61, 67 and 77-79, Commission Report).

Year	Scientific Advice	Decisions Made	Summary
	recommended a reduction of fishing mortality of 20% and that stable the nursery areas should have protection (Line 18, Table 1). For *M.barbatus* in GSAs 15/16 the Scientific Advisory Committee recommended a reduction in fishing mortality (current mortality was twice the target reference point) (Line 19, Table 1). For *P.erythrinus* in GSAs 15/16 the Scientific Advisory Committee recommended a reduction in fishing mortality (current mortality was twice the target reference point) (Line 20, Table 1). For *A.foliacea* in GSAs 15/16 the Scientific Advisory Committee recommended a reduction in fishing mortality (current		

Year	Scientific Advice	Decisions Made	Summary
	mortality was twice the target reference point) (Line 21, Table 1). For *S.solea* in GSA 17 the Scientific Advisory Committee recommended a reduction in fishing mortality (current mortality was six times the target reference point) (Line 22, Table 1). For *M.merluccius* in GSA 18 the Scientific Advisory Committee recommended a reduction in fishing mortality (current mortality was four times the target reference point) (Line 23, Table 1). For *M.barbatus* in GSA 25 the Scientific Advisory Committee recommended a reduction in fishing mortality by 24% (Line 24, Table 1).		

Year	Scientific Advice	Decisions Made	Summary
	For *M.surmuletus* in GSA 25 the Scientific Advisory Committee recommended a reduction in fishing mortality by 48-53% (Line 25, Table 1). For *S.smaris* in GSA 25 the Scientific Advisory Committee recommended a reduction in fishing mortality by 15% (Line 26, Table 1). For *B.boops* in GSA 25 the Scientific Advisory Committee recommended a reduction in fishing mortality by 15% (Line 27, Table 1). For *P.erytrinus* in GSA 26 the Scientific Advisory Committee recommended a reduction in fishing mortality by 45% along the Egyptian Coast and 60% in the area of Port Said (Line 28, Table 1).		

Year	Scientific Advice	Decisions Made	Summary
	For *S.pilchardus* in GSA 03 the Scientific Advisory Committee recommended maintaining fishing effort with the introduction of limits to protect spawning stocks including a seasonal closure in January (Line 1, Table 2). For *E.encrasicolus* in GSA 06 the Scientific Advisory Committee recommended that there be no increase in fishing effort as the stock was fully exploited (Line 2, Table 2). For *S.pilchardus* in GSA 06 the Scientific Advisory Committee recommended that fishing mortality needed to be reduced to the lowest level possible (Line 3, Table 2). For *E.encrasicolus* in GSA 07 the Scientific Advisory Committee recommended that		

Year	Scientific Advice	Decisions Made	Summary
	there should be no increase in fishing mortality (Line 4, Table 2). For *S.pilchardus* in GSA 07 the Scientific Advisory Committee recommended that there should be no increase in fishing effort because the stock is depleted (Line 5, Table 2). For *E.encrasicolus* in GSA 16 the Scientific Advisory Committee recommended that fishing effort should not be able to increase (Line 6, Table 2). For *S.pilchardus* in GSA 16 the Scientific Advisory Committee recommended that fishing effort should not be allowed to increase (Line 6, Table 2).		

Year	Scientific Advice	Decisions Made	Summary
	For *S.pilchardus* in GSA 17 the Scientific Advisory Committee recommended that fishing mortality should not be allowed to increase (Line 7, Table 2). For *E.encrasicolus* in GSA 17 the Scientific Advisory Committee recommended that there should be no increase in fishing mortality (Line 8, Table 2). For *E.encrasicolus* in GSA 18 the Scientific Advisory Committee recommended that there should be no increase in fishing mortality (Line 9, Table 2). For *S.pilchardus* in GSA 18 the Scientific Advisory Committee recommended that fishing mortality should not be allowed to increase (Line 10, Table 2).		

Year	Scientific Advice	Decisions Made	Summary
2013	From the Report of the Scientific Advisory Committee.[781] In a general overview the Committee stated that "in light of the worrying situation of most demersal stocks in the GFCM area [ ] actions should be taken to: i) reduce fishing mortality for demersal species and ii) improve selectivity patterns of demersal fisheries" (paragraph 70). The Scientific Advisory Committee did not provide advice on Sardine or Anchovy in GSAs 01, 02, 03, or 04 as there was no formal assessment or only a preliminary assessment (table 1, page 61).	From the Report of the General Fisheries Commission.[782] The EU and Tunisia both commented that a large number of stocks were either being overexploited or were overexploited and required a reduction in fishing mortality (paragraphs 42-43). The Executive Secretary noted that the proposed amendments to the GFCM Agreement would put in place a system for the Commission to adopt multi-annual guidelines (paragraph 47).	This year the Scientific Advisory Committee again made a number of clear recommendations to reduce fishing mortality (often by a large amount) that were not enacted into binding conservation measures. The difficulty appears to arise due to the strong emphasis on national plans, and a reliance on States parties to propose conservation measures (rather than have the Scientific Advisory Committee

[781] The Food and Agriculture Organization, 'Report of the fifteenth session of the Scientific Advisory Committee' (General Fisheries Commission For the Mediterranean, 8-11 April 2013).
[782] The Food and Agriculture Organization, 'Report of the thirty-seventh session of the Commission' (General Fisheries Commission for the Mediterranean, 13-17 May 2013).

Year	Scientific Advice	Decisions Made	Summary
	For Sardine in GSA 07 the Scientific Advisory Committee advised that the stock was under some environmental stress and fishing mortality should be kept at a minimum, but that the stock was not collapsed (table 1, page 62). For Anchovy in GSA 07 the Scientific Advisory Committee recommended that fishing mortality should not be allowed to increase (table 1, page 61). For Sardine in GSA 16 the Scientific Advisory Committee recommended that fishing mortality should not be allowed to increase (table 1, page 61). For Anchovy in GSA 16 the Scientific Advisory Committee recommended that	The Commission adopted a resolution on the methodology for the designation of GFCM protected areas (Annex E). The Commission adopted a recommendation (non-binding) aimed at increasing the sustainability of Sardine and Anchovy fisheries (Annex G).	recommend measures as in other RFMOs). It appears that States members are awaiting the amendments to the GFCM in order to adopt reductions in fishing mortality.

Year	Scientific Advice	Decisions Made	Summary
	fishing mortality be reduced in a multi-annual fishing plan (table 1, page 61). For Sardine in GSA 17 the Scientific Advisory Committee recommended that fishing mortality should not be allowed to increase (table 1, page 62). For Anchovy in GSA 17 the Scientific Advisory Committee recommended that fishing mortality should not be allowed to increase (table 1, page 62). For Sprat in GSA 29 the Scientific Advisory Committee recommended that the catch not exceed 100000 tonnes (table 1, page 64). For European Hake in GSA 01 the Scientific Advisory Committee		

Year	Scientific Advice	Decisions Made	Summary
	recommended a reduction in fishing mortality and an improvement in the selection of the fishery to reduce juvenile catches (table 2, page 65). For Hake in GSA 05 the Scientific Advisory Committee recommended a reduction in fishing mortality (table 2, page 65). For Hake in GSA 06 the Scientific Advisory Committee recommended a reduction in fishing mortality (table 2, page 65). For Hake in GSA 07 the Scientific Advisory Committee recommended a range of measures to improve selectivity, protect juveniles, impose spatial closures and reduce fishing effort (table 2, page 66).		

Year	Scientific Advice	Decisions Made	Summary
	For Hake in GSAs 12-16 the Scientific Advisory Committee recommended a reduction in fishing mortality by 80% (table 2, page 66). For Hake in GSA 18 the Scientific Advisory Committee recommended a 'remarkable reduction' in fishing mortality (table 2, page 67). For Blackspot Seabream in GSAs 01-03 the Scientific Advisory Committee recommended a reduction in fishing mortality (table 2, page 67). For Common Pandora in GSAs 15-16 the Scientific Advisory Committee recommended a reduction in fishing mortality of 60% (table 2, page 68).		

Year	Scientific Advice	Decisions Made	Summary
	For Common Sole in GSA 17 the Scientific Advisory Committee recommended a reduction in fishing pressure and temporal closures to protect recruitment (table 2, page 69). For Striped Red Mullet in GSA 05 the Scientific Advisory Committee recommended a reduction in fishing mortality, table 2, page 69). For Striped Red Mullet in GSA 07 the Scientific Advisory Committee recommended a reduction in trawl fishing effort (table 2, page 69). For Striped Red Mullet in GSAs 15-16 the Scientific Advisory Committee recommended a reduction in fishing		

Year	Scientific Advice	Decisions Made	Summary
	mortality and spatial limitations to protect recruitment (table 2, page 70). For Black Bellied Anglerfish in GSAs 15-16 the Scientific Advisory Committee recommended a reduction in fishing mortality (table 2, page 71). For Red Shrimp in GSA 05 the Scientific Advisory Committee recommended a reduction in fishing mortality and temporal closures to protect recruitment (table 2, page 72). For Red Shrimp in GSA 06 the Scientific Advisory Committee recommended a reduction in fishing mortality of 51%-59% (table 2, pages 73 and 74).		

Year	Scientific Advice	Decisions Made	Summary
	For Deep-water Pink Shrimp in GSA 18 the Scientific Advisory Committee recommended a reduction in fishing mortality (table 2, page 77). For Norway Lobster in GSA 05 the Scientific Advisory Committee recommended a reduction in fishing mortality (table 2, page 77). For Mantis Shrimp in GSA 17 the Scientific Advisory Committee recommended a reduction in fishing pressure (table 2, page 78). For Spiney Dogfish in GSA 29 the Scientific Advisory Committee recommended an increase in the collection of fisheries data (table 2, page 79).		

Year	Scientific Advice	Decisions Made	Summary
	For Whiting in GSA 29 the Scientific Advisory Committee recommended a reduction in fishing mortality (table 2, page 80). For Turbot in GSA 29 the Scientific Advisory Committee recommended the reduction of catches to the lowest possible level (table 2, page 81).		
2014	From the Report of the Scientific Advisory Committee.[783] The Scientific Advisory Committee report noted that many of the delegates and participants were concerned about the large number of stocks that were in a state of	From the Report of the General Fisheries Commission.[784]	This year the advice of the Scientific Advisory Committee was improved over previous years as they provided advice on nearly all stocks that noted how much the current fishing mortality

783 The Food and Agriculture Organization, 'Report of the sixteenth session of the Scientific Advisory Committee' (General Fisheries Commission for the Mediterranean, 17-20 March 2014).
784 The Food and Agriculture Organization, above n 761.

Year	Scientific Advice	Decisions Made	Summary
	overfishing. There was an agreement that a general reduction in fishing mortality was required (paragraphs 52-55). For Sardine in GSA 01 the Scientific Advisory Committee recommended that there be no increasing in fishing mortality (table 1, page 52). For Anchovy in GSA 06 the Scientific Advisory Committee recommended that there be no increasing in fishing mortality (table 1, page 52). For Sardine in GSA 06 the Scientific Advisory Committee recommended a reduction in fishing mortality (table 1, page 53).		was above the target fishing level. Additionally where there was insufficient information to undertake an assessment the Scientific Advice Committee provided precautionary advice based on previous assessments. This year during both the extraordinary meeting and the regular meeting of the GFCM amendments designed to modernise fisheries management were adopted. The amendments did not influence decision making at the Commission at this

Year	Scientific Advice	Decisions Made	Summary
	For Anchovy in GSA 07 the Scientific Advisory Committee recommended the implementation of a recovery plan as the biomass of the stock was below the limit point (table 1, page 53). For Sardine in GSA 07 the Scientific Advisory Committee recommended fishing mortality not be allowed to increase as the stock was "ecologically unbalanced" (table 1, page 53). For Sardine in GSA 16 the Scientific Advisory Committee recommended the reduction of fishing mortality as mortality was 11% above the target level (table 1, page 54). For Anchovy in GSA 16 the Scientific Advisory Committee recommended the		meeting. The Commission did adopt a measure to protect Anchovy and Sardine in GSA 17 but this did not go as far as recommended by the Scientific Advisory Committee. None of the other recommendations of the Scientific Advisory Committee resulted in management measures.

Year	Scientific Advice	Decisions Made	Summary
	reduction of fishing mortality as mortality was above the target level (table 1, page 54). For Sardine in GSA 17 the Scientific Advisory Committee recommended that fishing mortality be reduced (table 1, page 54). For Anchovy in GSA 17 the Scientific Advisory Committee recommended that fishing mortality be reduced (table 1, page 55). For Hake in GSA 01 the Scientific Advisory Committee recommended that fishing mortality be reduced and the pattern of fishing be improved (table 2, page 56). For Hake in GSA 03 the Scientific Advisory Committee could not make an assessment	The Commission adopted temporal closures as an emergency measure to protect Sardine and Anchovy in GSA 17 (Appendix G).	

Year	Scientific Advice	Decisions Made	Summary
	but on the basis of previous assessments recommended that there be no increase in fishing morality (table 2, page 56). For Hake in GSA 05 the Scientific Advisory Committee recommended a reduction in fishing mortality as the fishing level was eight times the target level (MSY) (table 2, page 56). For Hake in GSA 07 the Scientific Advisory Committee recommended a reduction in fishing mortality as the fishing level was twelve times the target level (MSY) (table 2, page 57). For Hake in GSAs 12-16 the Scientific Advisory Committee recommended a reduction in fishing mortality as the fishing		

Year	Scientific Advice	Decisions Made	Summary
	level was eight times the target level (MSY) (table 2, page 57). For Hake in GSA 18 the Scientific Advisory Committee recommended a reduction in fishing mortality as the fishing level was seven times the target level (MSY) (table 2, page 57). For Sole in GSA 17 the Scientific Advisory Committee recommended a reduction in fishing mortality as the fishing level was three times the target level (MSY) (table 2, page 58). For Red Mullet in GSA 05 the Scientific Advisory Committee recommended a reduction in fishing mortality as the fishing level was six times the target level (MSY) (table 2, page 58).		

Year	Scientific Advice	Decisions Made	Summary
	For Red Mullet in GSA 06 the Scientific Advisory Committee recommended a reduction in fishing mortality as the fishing level was two times the target level (MSY) (table 2, page 59). For Red Mullet in GSA 07 the Scientific Advisory Committee recommended a reduction in fishing mortality as the fishing level was four times the target level (MSY) (table 2, page 59). For Red Mullet in GSA 10 the Scientific Advisory Committee recommended that there be no increase in fishing mortality (table 2, page 59). For Red Mullet in GSA 17 the Scientific Advisory Committee recommended a		

Year	Scientific Advice	Decisions Made	Summary
	reduction in fishing mortality as the fishing level was five times the target level (MSY) (table 2, page 60). For Red Mullet in GSA 19 the Scientific Advisory Committee recommended a reduction in fishing mortality as the fishing level was three times the target level (MSY) (table 2, page 60). For Striped Red Mullet in GSA 05 the Scientific Advisory Committee recommended a reduction in fishing mortality as the fishing level was three times the target level (MSY) (table 2, page 60). For Striped Red Mullet in GSAs 15-16 the Scientific Advisory Committee recommended a reduction in fishing		

Year	Scientific Advice	Decisions Made	Summary
	mortality as the fishing level was four times the target level (MSY) (table 2, page 61). For Striped Red Mullet in GSA 26 the Scientific Advisory Committee recommended a reduction in fishing mortality as the fishing level was two times the target level (MSY) (table 2, page 61). For Blue Tooth Lizard Fish in GSA 26 the Scientific Advisory Committee recommended a reduction in fishing mortality as the fishing level was two times the target level (MSY) (table 2, page 62). For Picarel in GSA 25 the Scientific Advisory Committee recommended that there be no increase in fishing mortality (table 2, page 62).		

Year	Scientific Advice	Decisions Made	Summary
	For Red Shrimp in GSA 05 the Scientific Advisory Committee recommended a reduction in fishing mortality as the fishing level was four times the target level (MSY) (table 2, page 62). For Deep-water pink shrimp in GSA 05 the Scientific Advisory Committee recommended a reduction in fishing mortality as the fishing level was 20% above the target level (MSY) (table 2, page 62). For Deep-water pink shrimp in GSA 06 the Scientific Advisory Committee recommended a reduction in fishing mortality as the fishing level was five times the target level (MSY) (table 2, page 63). For Deep-water Pink Shrimp in GSAs 12-16 the Scientific Advisory Committee		

Year	Scientific Advice	Decisions Made	Summary
	recommended a reduction in fishing mortality as the fishing level was two times the target level (MSY) (table 2, page 63). For Deep-water Pink Shrimp in GSA 18 the Scientific Advisory Committee recommended a reduction in fishing mortality as the fishing level was two times the target level (MSY) (table 2, page 63). For Deep-water pink shrimp in GSA 18 the Scientific Advisory Committee recommended a reduction in fishing mortality as the fishing level was two times the target level (MSY) (table 2, page 63).		

Northwest Atlantic Fisheries Organisation

NAFO was formed in 1979 and has 12 members.[785] The Convention was signed in 1978 and, in 2007 major amendments to the Convention were adopted. These amendments have been ratified by two thirds of the parties and are expected to enter into force in the second half of 2017.[786] Prior to the amendments NAFO was constituted of three primary bodies, the General Council, the Fisheries Commission and the Scientific Council. The General Council has responsibility for administration and external relations.[787] The 2007 amendments abolished the General Council, with the Commission (to be open to all contracting parties) becoming the primary decision making body.[788] This is arguably already the case in practice as the Fisheries Commission is responsible for the management and conservation of the fishery resources of the Regulatory Area (waters outside the EEZs) and annually decides on the NAFO fisheries regulations, TACs and quotas.[789] The Fisheries Commission is made up of NAFO members who are actively fishing or intend to fish in the regulatory area.[790] The Fisheries Commission makes decisions on the basis of a majority vote, with a requirement for two thirds of its members to be present.[791] However, reported decision making over the period 2007–2012 clearly shows that conservation measures, as a matter or practice, are only taken when consensus exists. The Scientific Council is created by the NAFO Convention and provides its advice on the basis of consensus (a requirement continued by the 2007 amendments).[792]

The Fisheries Commission generally followed the advice of the Scientific Council when implementing conservation measures. Where recommendations of the Scientific Council went

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785 Northwest Atlantic Fisheries Organisation, *NAFO homepage* <http://www.nafo.int/>.
786 Northwest Atlantic Fisheries Organisation, *NAFO Convention* <http://www.nafo.int/about/overview/governance/intro.html>.
787 Northwest Atlantic Fisheries Organisation, above n 785.
788 2007 Amendments to the *NAFO Convention*, Art V– I.
789 Northwest Atlantic Fisheries Organisation, above n 785.
790 *NAFO Convention*, Art XIII.
791 *NAFO Convention*, Art XIV.
792 *NAFO Convention*, Art X.

unimplemented it was generally due to a lack of consensus as to appropriate measures for politically or economically difficult matters such as TAC on highly prized species. For example in 2004, 2005, 2007, 2010 and 2013 TACs were passed in excess of scientific advice due to a lack of consensus on the recommended TACs. On other occasions it was due to disagreements over scientific advice, as was the case in 2008, where a recommendation was not implemented due to a disagreement within the Scientific Council over the quality of modelling. On other occasion there were no reasons given for the failure to act on scientific advice. In 2006, 2009, 2011, 2012, 2013, 2014 and 2015 the Commission set TACs higher than recommended and did not report the reasons why. However, in later years the number of divergences from scientific advice were fewer, notably in both 2014 and 2015 there was only one stock where the Commission diverged dramatically. While the Fisheries Commission has a reasonable record of using scientific advice, the lack of reported reasons in the majority of cases where scientific advice was not followed indicates the importance of transparency in RFMO reporting. On other occasions it was a lack of consensus that prevented the enacting of measures based on scientific advice, but, in NAFOs case there is no legal requirement for consensus so its use is clearly a political, not legal constraint.

Table 5 - The Northwest Atlantic Fisheries Organisation

This table summarises the recommendations of the NAFO Scientific Council (the Scientific Council) compared with the decisions by the NAFO Fisheries Commission (the Commission), it is not intended to include every recommendation of the Committee and every act of the Commission, but rather focuses on those decisions that consider science-based questions. This analysis starts from 2004 as this marks the commencement of NAFO conservation measures being published.

Year	Scientific Advice	Decisions Made	Summary
2004	From the Scientific Council Report.[793] The Scientific Council recommended a TAC of no more than 15000 tonnes for Yellowtail Flounder in divisions 3L, 3N and 3O for 2005 and 2006 (page 18). The Scientific Council recommended a TAC of no more than 11000 tonnes for	From the Fisheries Commission Report.[794] The Commission implemented a TAC of 15000 tonnes for Yellowtail Flounder in divisions 3L, 3N and 3O for 2005 (page 102, paragraph 16.1). The Commission implemented a TAC for Thorny Skate in divisions 3L, 3N and 3O of	The Commission implemented many of the recommendations of the Scientific Committee. In some cases final TACs were higher than recommended or certain measures not adopted. This was largely due to a lack of consensus. However, in some cases final TACs were higher

793 Northwest Atlantic Fisheries Organisation Scientific Council, 'Scientific Council Reports 2004' (Northwest Atlantic Fisheries Organisation, January 2005).
794 Northwest Atlantic Fisheries Organisation, 'Meeting Proceedings of the General Council and Fisheries Commission September 2004–August 2005' (Northwest Atlantic Fisheries Organisation, August 2005).

Year	Scientific Advice	Decisions Made	Summary
	Thorny Skate in divisions 3L, 3N and 3O for 2005 and 2006 (page 19).	13500 tonnes for 2005, 2006 and 2007; this was higher than recommended by the Scientific Council (page 103, paragraph 16.8).	than recommended by the SC, or certain measures were not adopted. This was largely due to a lack of consensus. In most cases the Scientific Council's recommendations and the Commissions discussion of them and final decision were clearly noted in the Commission report.
	The Scientific Council recommended a TAC between 19000 and 34000 tonnes for Northern Shortfin Squid in sub-areas 3 and 4 for 2005 and 2006 (page 22).	The Commission implemented a TAC for Northern Shortfin Squid in sub-areas 3 and 4 for 2005 and 2006 of 34000 tonnes (page 102, paragraph 16.3).	
	The Scientific Council recommended a TAC of 45000 tonnes for Northern Shrimp in division 3M for 2006 (page 214).	The Commission could not reach consensus on a TAC of 45000 tonnes for Northern Shrimp in division 3M but instead rolled over conservation measures in force for 2004 (page 102, paragraph 15.3).	
	The Scientific Council recommended a TAC of no more than 22000 tonnes for Northern Shrimp in divisions 3L, 3N and 3O (page 216).	The Commission could not reach consensus on measures for Northern Shrimp in divisions 3L, 3N and 3O (page 102, paragraph 16.4).	

Year	Scientific Advice	Decisions Made	Summary
	The Scientific Council recommended closing the fishery for Cod in division 3M for 2005 and 2006 (page 13). The Scientific Council recommended closing the fishery for American Plaice in division 3M for 2005 and 2006 (page 14). The Scientific Council recommended closing the fishery for Witch Flounder in divisions 3N and 3O for 2005 and 2006 (page 16). The Scientific Council strongly recommended that the Council adopt the precautionary approach framework developed by the Scientific Council (page 52).	The Commission, in accordance with scientific advice, implemented closure of the Cod fishery in division 3M (page, 101, paragraph 15.1). The Commission, in accordance with scientific advice, implemented closure of the American Plaice fishery in division 3M (page, 101, paragraph 15.2). The Commission, in accordance with scientific advice, implemented closure of the Witch Flounder fishery in divisions 3N and 3O (page 102, paragraph 16.2). The Commission implemented the Scientific Council's approach to precautionary management and agree to begin testing it on two fisheries (page 97, paragraph 12).	

Year	Scientific Advice	Decisions Made	Summary
2005	From the Scientific Council Report.[795] In relation to Greenland Halibut in sub-area 2 and divisions 3K, 3L, 3M, 3N and 3O the Scientific Council advised that if fishing was in accordance with current TACs there was a very low probability of the stock rebuilding. It also noted that the catch for 2004 had been 27% greater than the planned TAC (pages 10-11). The Scientific Council recommended a TAC of between 3000 and 5000 tonnes for Redfish in in division 3M for 2006 – 2007 (page 19).	From the Fisheries Commission Report.[796] The Commission decided to retain the TAC of 13709 tonnes for Greenland Halibut in divisions 3L, 3M, 3N and 3O, despite advice from the Scientific Council that such a TAC had a very low probability of rebuilding the stock (page 122, paragraph 18.8). The Commission determined to implement the scientific advice in relation to Redfish in division 3M (page 121, paragraph 16.1).	The Commission adopted nearly all recommendations of the Scientific Council relating to fishing effort. In the two cases where they did not (Witch Flounder and Greenland Halibut) there were previously agreed measures in place and consensus could not be reached on new measures.

[795] Northwest Atlantic Fisheries Organisation Scientific Council, 'Scientific Council Reports 2005' (Northwest Atlantic Fisheries Organisation, January 2006).
[796] Northwest Atlantic Fisheries Organisation, 'Meeting Proceedings of the General Council and Fisheries Commission for 2005/2006' (Northwest Atlantic Fisheries Organisation, June 2006).

Year	Scientific Advice	Decisions Made	Summary
	The Scientific Council recommended a TAC for Northern Shrimp in division 3M of 48000 tonnes for 2007 (page 218).	The Commission could not reach consensus in relation to Northern Shrimp in division 3M as Iceland maintained an objection. The Commission determined to continue the measures in force for 2005 and note Iceland's reservation (page 121, paragraph 16.2).	
	The Scientific Council could not advise on a TAC for Redfish in division 3O for 2006 – 2007 due to insufficient information (page 23).	The Commission decided to continue the previously agreed TAC for Redfish in division 3O in the absence of new scientific advice (page 121, paragraph 18.2).	
	The Scientific Council advised that current TACs of 8500 tonnes for White Hake in divisions 3N and 3O was unsustainable (page 25).	The Commission decided that there would be no change to the TAC for White Hake in divisions 3N and 3O despite the advice from the Scientific Council that the level of catch was unsustainable (page 122, paragraph 18.6).	

Year	Scientific Advice	Decisions Made	Summary
	The Scientific Council recommended that there be no increase to the TAC of 22000 tonnes for Northern Shrimp in divisions 3L, 3N and 3O for several years (page 219). The Scientific Council recommended that there be no directed fishing for Cod in divisions 3N and 3O and that efforts be made to reduce by-catch (page 14). The Scientific Council recommended that there be no directed fishing for American Plaice in divisions 3L, 3N and 3O and that efforts are made to reduce by-catch (page 15). The Scientific Council recommended that there be no directed fishing for Witch Flounder in divisions 2J, 3K and 3L and	The Commission decided on a TAC for Northern Shrimp of 22000 tonnes in divisions 3L, 3N and 3O (page 122, paragraph 18.9). The Commission prohibited directed fishing for Cod in divisions 3N and 3O (page 121, paragraph 18.1). The Commission prohibited directed fishing for American Plaice in divisions 3L, 3N and 3O (page 121, paragraph 18.3). The Commission prohibited directed fishing for Witch Flounder in divisions 2J, 3K and 3L (page 121, paragraph 18.4).	

Year	Scientific Advice	Decisions Made	Summary
	that efforts are made to reduce by-catch (page 17). The Scientific Council recommended that there be no directed fishing for Redfish in divisions 3L and 3N for 2006 – 2007 (page 20). The Scientific Council recommended that there be no directed fishing for Capelin in divisions 3N and 3O for 2006 – 2007 (page 24).	The Commission prohibited directed fishing for Redfish in divisions 3L and 3N for 2006 – 2007 (page 121, paragraph 18.2). The Commission prohibited directed fishing for Capelin in divisions 3N and 3O (page 122, paragraph 18.7). The Commission adopted measures aimed at preventing shark finning (page 122, paragraph 18.11)	

Year	Scientific Advice	Decisions Made	Summary
2006	From the Scientific Council Report.[797] The Scientific Council reiterated its advice that if the rebuilding TAC for Greenland Halibut in sub-area 2 and divisions 3K, 3L, 3M, 3N and 3O continued to be exceeded, the chance of the stock rebuilding would be further diminished from an already low likelihood (page 9). The Scientific Council recommended a TAC of no more than 15500 tonnes for Yellowtail Flounder in divisions 3L, 3N and 3O for 2007 – 2008 (page 17).	From the Fisheries Commission Report.[798] The Commission decided not to change the rebuilding plan for Greenland Halibut, despite the Scientific Council's recommendation that it had a low likelihood of success (page 162, paragraph 12.5). The Commission agreed to a TAC of 15500 tonnes for Yellowtail Flounder in division 3L, 3N and 3O for 2007 – 2007 despite requests from the United States for a higher TAC (page 162, paragraph 12.2).	The Commission largely adopted the advice of the Scientific Council. However there were some cases where they did not, notably Greenland Halibut and Thorny Skate, no explanation for moving away from the advice of the Scientific Council was given.

[797] Northwest Atlantic Fisheries Organisation Scientific Council, 'Scientific Council Reports 2006' (Northwest Atlantic Fisheries Organisation, February 2007).
[798] Northwest Atlantic Fisheries Organisation, 'Meeting Proceedings of the General Council and Fisheries Commission for 2006/2007' (Northwest Atlantic Fisheries Organisation, , August 2007).

Year	Scientific Advice	Decisions Made	Summary
	The Scientific Council recommended a TAC of 11000 tonnes for Thorny Skate in divisions 3L, 3N and 3O and subdivision 3Ps for 2007 – 2008 (page 19). The Scientific Council recommended a TAC of between 19000 and 34000 for Northern Shortfin Squid in sub-areas 3 and 4 for 2007 – 2008 (page 21). The Scientific Council advised that the current TAC for 48000 for Northern Shrimp in division 3M may not be sustainable because of a poor year class (page 215).	The Commission agreed a TAC of 13500 tonnes for Thorny Skate in divisions 3L, 3N and 3O for 2007, this was greater than the 11000 tonnes recommended by the Scientific Council, no further explanation given (page 162, paragraph 12.3). The Commission agreed a TAC of 34000 tonnes for Northern Shortfin Squid in sub-areas 3 and 4 for 2007 – 2008 (page 162, paragraph 12.4). This was at the maximum of the Scientific Council recommended range. The Commission could not reach consensus on a TAC for Northern Shrimp in division 3M so previous conservation measures were continued (page 161, paragraph 11.3).	

Year	Scientific Advice	Decisions Made	Summary
	The Scientific Council recommended a TAC of 22000 tonnes for Northern Shrimp in division 3L, 3N and 3O for 2008 with fishing limited to 3L, they also recommended some fishing gear limitations (page 218). The Scientific Council recommended that there be no directed fishing for Cod in division 3M for 2007 – 2008 (page 12). The Scientific Council recommended that there be no directed fishing for American Plaice in division 3M for 2007 – 2008 (page 13). The Scientific Council recommended that there be no directed fishing for Witch Flounder in divisions 3N and 3O for 2007 – 2008 (page 15).	The Commission decided on a TAC of 22000 tonnes for Northern Shrimp in divisions 3L, 3N and 3O for 2007 (page 162, paragraph 12.6). The Commission continued the prohibition on directed fishing of Cod in division 3M for 2007 - 2008 (page 161, paragraph 11.1). The Commission continued the prohibition on directed fishing of American Plaice in division 3M for 2007 – 2008 (page 161, paragraph 11.2). The Commission continued the prohibition on directed fishing of Witch Flounder in divisions 3N and 3O) for 2007 – 2008 (page 162, paragraph 12.1).	

Year	Scientific Advice	Decisions Made	Summary
	The Scientific Council advised that the pelagic Redfish stock was in rapid decline with catches exceeding those recommended by ICES (pages 22-24).	The Commission revised the TAC for pelagic Redfish down to 16914 tonnes (based on a reduction in the NEAFC TAC with which the stock is shared) and adopted new measures on mesh size (page 162, paragraph 12.7).	
2007	From the Scientific Council Report.[799] For Greenland Halibut in sub-area 2 and divisions 3K, 3L, 3M, 3N and 3O, the Scientific Council recommended that fishing mortality should be reduced to a level not higher than F0.1, or alternatively, catches over the next four years should be reduced by 15% annually from the 2007 TAC (16 000 tons) (page 13).	From the Fisheries Commission Report.[800] The Commission set a TAC of 16000 tonnes for Greenland Halibut in sub-area 2 and divisions 3K, 3L, 3M, 3N and 3O; this was inconsistent with advice from the Scientific Council (page 86, paragraph 8.9).	The Commission set TACs that were greatly in excess of Scientific Council recommendations for many species, including Redfish, White Hake, Greenland Flounder and Thorny Skate. In all cases the Commission failed

799 Northwest Atlantic Fisheries Organisation Scientific Council, 'Scientific Council Reports 2007' (Northwest Atlantic Fisheries Organisation, March 2008).
800 Northwest Atlantic Fisheries Organisation, 'Meeting Proceedings of the General Council and Fisheries Commission for 2007/2008' (Northwest Atlantic Fisheries Organisation, July 2008).

Year	Scientific Advice	Decisions Made	Summary
	The Scientific Council recommended a TAC of not more than 5000 tonnes for Redfish in division 3M for 2008 - 2009 (page 21). The Scientific Council could not advise on a TAC for Redfish in division 3O for 2008 – 2010 (page 28). The Scientific Council recommended that the current TAC for White Hake in divisions 3N and 3O of 8500 tonnes is unsustainable (page 23). The Scientific Council recommended a TAC for Northern Shrimp in division 3M of 17000 – 32000 tones (page 212).	The Commission established a TAC of 8500 tonnes for Redfish in division 3M, contrary to the advice from the Scientific Council, for 2008-2009 (page 85, paragraph 7.1). The Commission set a TAC of 20000 tonnes for Redfish in division 3O for 2008 (page 86, paragraph 8.5). The Commission established a TAC of 8500 tonnes for White Hake in divisions 3N and 3O for 2008-2009, contrary to the advice of the Scientific Council (page 85, paragraph 8.3). There was no change to the management measures for Northern Shrimp in division 3M as agreement could not be reached (page 85, paragraph 7.2).	to identify the reason for the departure, even where there were reservations from Member States.

Year	Scientific Advice	Decisions Made	Summary
	The Scientific Council recommended a TAC of 25000 tonnes be maintained for Northern Shrimp in divisions 3L, 3N and 3O for 2008 -2009 and that fishing be limited to division 3L (page 214).	The Commission set a TAC of 25000 tonnes for Northern Shrimp in divisions 3L, 3N and 3O for 2008 (page 86, paragraph 8.10).	
	The Scientific Council recommended that there be no directed fishing for American Plaice in divisions 3L, 3N and 3O for 2008 – 2009 (page 19).	The Commission continued the prohibition on directed fishing of American Plaice in divisions 3L, 3N a 3O (page 85, paragraph 8.1).	
	The Scientific Council recommended that there be no directed fishing for Capelin in divisions 3N and 3O for 2008 and 2009 (page 24).	The Commission continued the prohibition on directed fishing of Capelin in divisions 3N and 3O until 2012 (page 86, paragraph 8.8).	
	The Scientific Council recommended that there be no directed fishing for Redfish in divisions 3L and 3N for 2008–2010 (page 26).	The Commission continued the prohibition on directed fishing for Redfish in divisions 3L and 3N for 2008 and put in place additional by-catch protection (page 85, paragraph 8.4).	

Year	Scientific Advice	Decisions Made	Summary
	The Scientific Council recommended that there be directed fishing for Cod in division 3N and 3O for 2008–2010 (page 30).	The Commission continued the prohibition on directed fishing for Cod in division 3N and 3O until 2010 (86, paragraph 8.5).	
	The Scientific Council recommended that there be no directed fishing for Witch Flounder in divisions 2J, 3K and 3L for 2008–2010 (page 31).	The Commission set a prohibition on directed fishing for Witch Flounder in division 3L for 2008-2010, the recommendation from the Scientific Council included divisions 2J and 3K which were not considered by the Council (page 86, paragraph 8.7).	
	The Scientific Council recommended a TAC of not more than 15500 tonnes for Yellowtail Flounder in division 3L, 3N and 3O in 2006 (page 36).	The Commission set a TAC of 15500 tonnes for Yellowtail Flounder in divisions 3L, 3N and 3O for 2008 (page 85, paragraph 8.2), this was despite request from the United States to increase the TAC.	

Year	Scientific Advice	Decisions Made	Summary
	The Scientific Council recommended a TAC of 11000 tonnes for Thorny Skate in 2007 (page 36). The Scientific Council recommended a TAC of between 19000 and 34000 tonnes for Northern Shortfin Squid in 2007 (page 36). The Scientific Council could not recommend a TAC for Redfish in division 3O (page 28).	The Commission set a TAC of 13500 tonnes for Thorny Skate in divisions 3L, 3N and 3O; this was inconsistent with advice from the Scientific Council provided at the 2007 and affirmed in 2008 (page 87, paragraph 8.12). The Commission set a TAC of 34000 tonnes for Northern Shortfin Squid in sub-areas 3 and 4 (page 87, paragraph 8.13). The Commission set a mesh size of 90mm for the Redfish fishery in division 3O (page 86, paragraph 8.5).	
2008	From the Scientific Council Report.[801]	From the Fisheries Commission Report.[802]	The Commission created conservation measures in

801 Northwest Atlantic Fisheries Organisation Scientific Council, 'Scientific Council Reports 2008' (Northwest Atlantic Fisheries Organisation, February 2009).
802 Northwest Atlantic Fisheries Organisation, 'Meeting Proceedings of the General Council and Fisheries Commission for 2008/2009' (Northwest Atlantic Fisheries Organisation, August 2009).

Year	Scientific Advice	Decisions Made	Summary
	The Scientific Council recommended that catches of Greenland Halibut in sub-area 2 and divisions 3K, 3L, 3M, 3N and 3O be no greater than F-0.1 until 2013 (that is approximately 10000 tonnes) (pages 11-13).	The Commission set a TAC of 16000 tonnes for Greenland Halibut in sub-area 2 and divisions 3K, 3L, 3M, 3N and 3O, this is higher than recommended by the Scientific Council, the Commission suggested that it did not trust the robustness of the model used by the Council and asked them to examine other assessment methods (page 114, paragraph 9.6).	response to most recommendations of the Scientific Council. Where the Commission created measures that were in excess of Scientific Council recommendations it provided reasons, such as not trusting the model used or not believing the assessment followed from the results.
	The Scientific Council recommended a TAC for Thorny Skate in divisions 3L, 3N, 3O and 3Ps of no more than 6000 tonnes for 2009 - 2010 (page 19).	The Commission set a TAC of 13500 tonnes for Thorny Skate in divisions 3L, 3N and 3O, this was in excess of the recommendation from the Scientific Council, the Commission said that this was because with catches of 6000 tonnes (as recommended) catches had been increasing (page 114, paragraph 9.5).	
	The Scientific Council recommended a TAC for Redfish in divisions 3L and 3N of no more than 3500 tonnes (page 28).	The Commission continued the prohibition on directed fishing for Redfish in 3L and 3N for	

Year	Scientific Advice	Decisions Made	Summary
		2009, this was more conservative than the scientific advice (page 113, paragraph 9.3).	
	The Scientific Council did not have enough information to make a recommendation for a TAC for Northern Shrimp in division 3M but noted the low recruitment (pages 251 – 252).	The Commission could not come to a decision regarding Northern Shrimp in 3M as there was no consensus, previous conservation measures were continued (page 113, paragraph 8.3).	
	The Scientific Council provided a number of options in relation to Northern Shrimp in divisions 3L, 3N and 3O. Option one was to keep exploitation at around 15% (approx. 30000 tonnes) option two was to increase exploitation by approximately 1% per year until 2010 (page 254).	The Commission set a TAC for Northern Shrimp of 30000 tonnes in divisions 3L, 3N and 3O for 2009 (page 114, paragraph 9.8).	
	The Scientific Council recommended no directed fishing for Witch Flounder in	The Commission decided to prohibit the directed fishing of Witch Flounder in divisions	

Year	Scientific Advice	Decisions Made	Summary
	divisions 3N and 30 for 2009 – 2011 (page 22). The Scientific Council recommended no directed fishing for American Plaice in division 3M for 2009 – 2011 (page 23). The Scientific Council recommended no directed fishing for Cod in division 3M for 2009 (page 26). The Scientific Council recommended an increase in TAC up to approximately 24000 tonnes for Yellowtail Flounder in divisions 3L, 3N and 3O for 2009 – 2010 (page 20).	3N and 3O for 2009 – 2011 (page 113, paragraph 9.1). The Commission decided to continue the prohibition on directed fishing for American Plaice in division 3M for 2009 – 2011 (page 113, paragraph 8.2). The Commission decided to continue the prohibition on directed fishing for Cod in division 3M for 2009 (page 113, paragraph 8.1). The Commission set a TAC for Yellowtail Flounder of 17000 tonnes in divisions 3L, 3N and 3O this was more conservative than the scientific advice (page 113, paragraph 9.2).	

Year	Scientific Advice	Decisions Made	Summary
2009	From the Scientific Council Report.[803] The Scientific Council recommended that the TAC for Greenland Halibut in sub-area 2 and divisions 3K, 3L, 3N and 3O be reduced to no more than F-0.1 (or approximately 16000 tonnes (page 9). The Scientific Council recommended that the TAC for Redfish in divisions 3N and 3L not exceed 3500 tonnes (page 11). The Scientific Council recommended that the TAC for Redfish in division 3M of no more than 8500 tonnes (page 18).	From the Fisheries Commission Report.[804] The Commission set a TAC for Greenland Halibut in divisions 3K, 3L, 3M, 3N and 3O of 16000 tonnes for 2009 – 2010 (page 92, paragraph 9.3). The Commission set a TAC for Redfish in divisions 3L and 3N of 3500 tonnes (page 92, paragraph 9.3). The Commission set TAC for Redfish in division 3M of 10000 tonnes (page 91,	The Commission set TACs above those recommended by the Scientific Council without providing an explanation in the Commission report.

803 Northwest Atlantic Fisheries Organisation Scientific Council, 'Scientific Council Reports 2009' (Northwest Atlantic Fisheries Organisation, January 2010).
804 Northwest Atlantic Fisheries Organisation, 'Meeting Proceedings of the General Council and Fisheries Commission for 2009/2010' (Northwest Atlantic Fisheries Organisation, August 2010).

Year	Scientific Advice	Decisions Made	Summary
		paragraph 8.2) This was in excess of the advice of the Scientific Council (page 88).	
	The Scientific Council recommended a TAC of no more than 85% MSY for Yellowtail Flounder in divisions 3L, 3N and 3O (page 15).	The Commission set a TAC for Yellowtail Flounder in divisions 3L, 3N and 3O of 17000 tonnes (page 91, paragraph 9.2).	
	The Scientific Council recommended that there could be a small TAC of up to approximately 900 tonnes for Cod in division 3M (page 19).	The Commission set a TAC for Cod in division 3M of 5500 tonnes (page 90, paragraph 8.1). This was in excess of the recommendation of the Scientific Council.	
	The Scientific Council recommended that the current TAC of 8500 tonnes for White Hake in divisions 3N, 3P and 3O was unsustainable and should be reduced to 850 tonnes (page 22).	The Commission set a TAC for White Hake in divisions 3N and 3O of 6000 tonnes (page 92, paragraph 9.7) This was in excess of the advice of the Scientific Council (page 88). The Commission set a TAC for Northern Shrimp in divisions 3L, 3N and 3O of 30000	

Year	Scientific Advice	Decisions Made	Summary
	The Scientific Council recommended that there be no increase in TAC for Northern Shrimp in division 3L, 3N and 3O (page 203).	tonnes for 2009 – 2010, an increase of the previous TAC and contrary to the advice of the Scientific Council (page 92, paragraph 9.8).	
	The Scientific Council recommended that there be no directed fishing for American Plaice in division 3L, 3N and 3O (page 12).	The Commission agreed to a continued prohibition on capture of American Plaice in divisions (page 91, paragraph 9.1).	
	The Scientific Council recommended that there be no directed fishing for Capelin in division 3N and 3O (page 23).	The Commission agreed to continue a prohibition on directed fishing for Capelin in divisions 3N and 3O for 2010 – 2011 (page 92, paragraph 9.5).	
	The Scientific Council recommended that there be no fishing mortality for Northern Shrimp in division 3M (page 202).	The Commission reduced effort for the Northern Shrimp fishery in division 3M by 50% (page 185).	

Year	Scientific Advice	Decisions Made	Summary
	The Scientific Council recommended a TAC for Thorny Skate in divisions 3L, 3N, 3O and 3Ps of no more than 6000 tonnes for 2009 - 2010 in 2008 and did not change this advice following a review (page 24).	The Commission set a TAC for Thorny Skate of 12000 tonnes (page 93 paragraph 9.11). This was contrary to the advice of the Scientific Council (page 89). The Commission set a TAC for Redfish in division 3O of 20000 tonnes for 2009 - 2010 (page 92, paragraph 9.4) There was no scientific advice on this stock.	
2010	From the Scientific Council Report.[805] The Scientific Council recommended a TAC for Greenland Halibut in sub-area 2 and divisions 3K, 3L, 3M, 3N and 3O of 14500 tonnes in 2011 (pages 16 -21).	From the Fisheries Commission Report.[806] The Commission set a TAC of 17185 tonnes for Greenland Halibut in divisions 3K, 3L, 3M, 3N and 3O, this was 3000 tonnes above that recommended by the Scientific Council following the recommendation of the Greenland	The Commission followed scientific advice for most conservation measures. Where a measure could not be implemented in accordance with scientific advice it was noted in the report of the

[805] Northwest Atlantic Fisheries Organisation Scientific Council, 'Scientific Council Reports 2010' (Northwest Atlantic Fisheries Organisation, March 2011).
[806] Northwest Atlantic Fisheries Organisation, 'Meeting Proceedings of the General Council and Fisheries Commission for 2010/2011' (Northwest Atlantic Fisheries Organisation, September 2011).

Year	Scientific Advice	Decisions Made	Summary
		Halibut working group (page 124, paragraph 10.9).	Commission the noted reason in all cases was lack of consensus.
	The Scientific Council recommended a TAC for Cod in division 3M of less than 10000 tonnes (page 27).	The Commission set a TAC of 10000 tonnes for Cod in division 3M (page 122, paragraph 9.1).	
	The Scientific Council recommended a TAC of 6000 tonnes for Redfish in divisions 3L and 3N (page 32).	The Commission set a TAC for Redfish in divisions 3L and 3N of 6000 tonnes (page 123, paragraph 10.2).	
	The Scientific Council could not recommend a TAC for Redfish in 3O but advised that catches 10000 tonnes appeared to be sustainable (pages 33-34).	The Commission set a TAC for Redfish in division 3O of 20000 tonnes (page 123, paragraph 10.3), this was higher than the 10000 tonnes that the Scientific Council advised was sustainable.	
	The Scientific Council recommended a TAC for Thorny Skate in divisions 3N, 3L	The Commission set a TAC of 12000 tonnes for Thorny Skate in divisions 3L, 3N and 3O; this was in excess of the 5000 tonnes recommended	

Year	Scientific Advice	Decisions Made	Summary
	and 3O of less than 5000 tonnes for 2011-2012 (page 36). The Scientific Council recommended a TAC for Northern Shortfin Squid in sub-areas 3 and 4 of between 19000 tonnes and 34000 tonnes for 2011–2013 (page 40). The Scientific Council advised that a TAC of 24000 tonnes would result in a decrease in the stock of Northern Shrimp in divisions 3L, 3N and 3O (page 239). The Scientific Council recommended that there be no directed fishing for American Plaice in divisions 3L, 3N and 3O for 2011 (page 24).	by the Scientific Council due to a lack of agreement (page 123, paragraph 10.7). The Commission set a TAC of 34000 tonnes for Northern Shortfin Squid in sub-areas 3 and 4 (page 124, paragraph 10.12). The Commission set a TAC for 19400 tonnes for Northern Shrimp in divisions 3L, 3N and 3O (page 124, paragraph 10.10). The Commission set a rebuilding strategy for American Plaice which included limit points where the fishery could be restarted (page 124, paragraph 10.11).	

Year	Scientific Advice	Decisions Made	Summary
	The Scientific Council recommended that there be no directed fishing for Cod in divisions 3N and 3O for 2011 – 2012 (page 30). The Scientific Council recommended that there be no directed fishing for Witch Flounder in divisions 2J, 3K and 3L for 2011–2013 (page 37). The Scientific Council recommended that there be zero mortality for Northern Shrimp in division 3M (page 237). The Scientific Council recommended protecting some seamounts (pages 34 -38).	The Commission prohibited directed fishing for Cod in divisions 3N and 3O (page 123, paragraph 10.1). The Commission prohibited directed fishing for Witch Flounder in division 3L for 2011–2013 (page 123, paragraph 10.5). This did not include divisions 2J and 3K. The Commission prohibited fishing for Northern Shrimp in division 3M for 2011 (page 122, paragraph 9.3). The Commission enacted measures for seamounts in accordance with scientific advice from the Committee (page 125, paragraph 11).	

Year	Scientific Advice	Decisions Made	Summary
2011	From the Scientific Council Report.[807] The Scientific Council recommended that the TAC for Cod in division 3M not exceed 9280 tonnes for 2012 (page 18). The Scientific Council recommended a TAC for Redfish in division 3M of no more than 6500 tonnes for 2012-2013 (page 15). The Scientific Council recommended a TAC for Yellowtail Flounder in divisions 3L, 3N and 3O of up to 25000 tonnes (85% F MSY) (page 24). The Scientific Council advised that the current TAC of 6000 tonnes for White	From the Fisheries Commission Report.[808] The Commission set a TAC for Cod in division 3M of 9280 tonnes (page 84, paragraph 9.1). The Commission set a TAC for Redfish in division 3M of 6500 tonnes for 2012 – 2013 (page 84, paragraph 9.2). The Commission set a TAC for Yellowtail Flounder in divisions 3L, 3N and 3O of 17000 tonnes (page 85, paragraph 10.5).	The Commission again set a TAC for Thorny Skate that was in excess of the recommendation of the Scientific Council with no explanation; this also occurred with the TAC set for Northern Shrimp in divisions 3L, 3N and 3O.

[807] Northwest Atlantic Fisheries Organisation Scientific Council, 'Scientific Council Reports 2011' (Northwest Atlantic Fisheries Organisation, January 2012).
[808] Northwest Atlantic Fisheries Organisation, 'Meeting Proceedings of the General Council and Fisheries Commission for 2011/2012' (Northwest Fisheries Organisation, September 2012).

Year	Scientific Advice	Decisions Made	Summary
	Hake in divisions 3N and 3O was unrealistic and should be set lower (page 28). The Scientific Council recommended that there be no directed fishing for Capelin in divisions 3N and 3O for 2012 – 2013 (page 26). The Scientific Council recommended that there be no catch of Northern Shrimp in division 3M for 2012 (page 219). The Scientific Council recommended a TAC of less than 9350 tonnes for Northern Shrimp in divisions 3L, 3N and 3O for 2012 (page 222)	The Commission set a TAC of 5000 tonnes for White Hake in divisions 3N and 3O (page 85, paragraph 10.7). The Commission agreed to continue the prohibition on directed fishing for Capelin in divisions 3N and 3O for 2012 – 2013 (page 85, paragraph 10.8). The Commission agreed to a prohibition on directed fishing for Northern Shrimp in division 3M (page 84, paragraph 9.4). The Commission set a TAC for Northern Shrimp in divisions 3L, 3N and 3O of 12000 tonnes in 2012 and 9350 tonnes (the level recommended by the Scientific Council) in 2013 (page 85, paragraph 10.11).	

Year	Scientific Advice	Decisions Made	Summary
	The Scientific Council recommended that there be no directed fishing for American Plaice in divisions 3L, 3N and 3O for 20122013 (page 12).	The Commission agreed to a prohibition on directed fishing of American Plaice in divisions 3L, 3N and 3O for 2012–2013 (page 85, paragraph 10.4).	
	The Scientific Council recommended that there be no directed fishing for American Plaice in division 3M for 2012-2014 (page 19).	The Commission agreed to a prohibition on the directed fishing for American Plaice in division 3M for 2012–2014 (page 84, paragraph 9.3).	
	The Scientific Council recommended that there be no directed fishing for Witch Flounder in divisions 3N and 3O for 2012–2014 (page 21).	The Commission agreed to a prohibition on directed fishing for Witch Flounder in divisions 3N and 3O for 2012 (page 85, paragraph 10.6).	
	In 2010 the Scientific Council recommended a TAC for Thorny Skate in divisions 3N, 3L and 3O of less than 5000 tonnes for 2011-2012.	The Commission set a TAC for Thorny Skate in divisions 3L, 3N, 3O of 8500 tonnes; this was well in excess of advice from the Scientific Council (page 85, paragraph 10.9).	

Year	Scientific Advice	Decisions Made	Summary
		The Commission set a TAC for Greenland Halibut in sub-area 2 and divisions 3K, 3L, 3M, 3N and 3O of 16326 tonnes based on the current rebuilding plan (page 85, paragraph 10.10).	
2012	From the Scientific Council Report.[809] The Scientific Council recommended a TAC of approximately 6000 tonnes for Redfish in divisions 3L and 3N (page 13). The Scientific Council recommended a TAC of less than 4700 tonnes for Thorny Skate in divisions 3N, 3L, 3O and 3P (page 15).	From the Fisheries Commission Report.[810] The Commission set a TAC of 6500 tonnes for Redfish in divisions 3L and 3N (page 108, paragraph 13.1). The Commission set a TAC of 7000 tonnes for Thorny Skate in divisions 3L, 3N and 3O for 2013 – 2014. This was in excess of the recommendation of the Scientific Council (page 108, paragraph 13.8).	The Commission adopted all recommendations from the Scientific Council, including some recommendations from previous years that had not yet been acted on. The exception was Thorny Skate for which a higher TAC was set with no explanation given.

[809] Northwest Atlantic Fisheries Organisation Scientific Council, 'Scientific Council Reports 2012' (Northwest Atlantic Fisheries Organisation, January 2013).
[810] Northwest Atlantic Fisheries Organisation, 'Meeting Proceedings of the General Council and Fisheries Commission for 2012/2013' (Northwest Atlantic Fisheries Organisation, September 2012).

Year	Scientific Advice	Decisions Made	Summary
	The Scientific Council recommended a TAC of less than 8500 tonnes for Northern Shrimp in divisions 3L, 3N and 3O (page 195). The Scientific Council recommended that there be no directed fishing for American Plaice in divisions 3L, 3N and 3O (page 23). The Scientific Council recommended that there be no directed fishing for Northern Shrimp in division 3M (page 195).	The Commission set a TAC of 8600 tonnes for Northern Shrimp in divisions 3L, 3N and 3O (fishing was confined to 3L) this was in excess of the recommendation of the Scientific Council (page 109, paragraph 13.10). The Commission continued the prohibition on directed fishing for American Plaice in divisions 3L, 3N and 3O (page 108, paragraph 13.4). The Commission prohibited fishing for Northern Shrimp in division 3M (page 107, paragraph 12.2). The Commission set a TAC of 20000 tonnes for Redfish in division 3O (the Scientific Council could not recommend a TAC for this stock) (page 108, paragraph 13.2).	

Year	Scientific Advice	Decisions Made	Summary
		The Commission set the TAC for White Hake in divisions 3N and 3O at 1000 tonnes following scientific advice from 2011 (page 108, paragraph 13.7). The Commission adopted all recommendations from the Scientific Council (and working group) on measures to protect Vulnerable Marine Ecosystems.	
2013	From the Scientific Council Report.[811] For Cod in division 3M the Scientific Council advised that current fishing mortality was unsustainable and fishing should be limited to below 14000 tonnes (pages 17-18).	From the Fisheries Commission Report.[812] For Cod in division 3M the Commission set a TAC 14521 tonnes (page 87).	This year the Scientific Council Report had a new structure in which they used coloured 'traffic lights' indicate the status of stocks and the status of the scientific work to understand them.

[811] Northwest Atlantic Fisheries Organisation, 'Scientific Council Reports 2013' (Northwest Atlantic Fisheries Organisation, 2013).
[812] Northwest Atlantic Fisheries Organisation, 'Meeting Proceedings of the General Council and Fisheries Commission for 2013/2014' (Northwest Atlantic Fisheries Organisation, 2013).

Year	Scientific Advice	Decisions Made	Summary
	For Redfish in division 3M the Scientific Council advised that the current TAC of 6500 tonnes should not be increased (pages 20). For Yellowtail Flounder in divisions 3L, 3N and 3O the Scientific Council recommended a TAC 26000 tonnes in 2014 and 23500 tonnes in 2015 (page 22). For White Hake in divisions 3N and 3O the Scientific Council recommended that the catches should not exceed current levels of 100 – 300 tonnes (page 25). For Capelin in divisions 3N and 3O the Scientific Council recommended that there be no directed fishery (page 27).	For Redfish in division 3M the Commission set the TAC at 6500 tonnes (page 87). For Yellowtail Flounder in divisions 3L, 3N and 3O the Commission set the TAC at 17000 tonnes (page 88). For White Hake in divisions 3N and 3O the Commission set a TAC of 1000 tonnes (page 88). For Capelin in divisions 3N and 3O the Commission prohibited the directed fisheries (page 88).	This year the Commission normally enacted conservation measures in accordance with the advice of the Scientific Council, especially in regards to prohibitions on directed fishing. However in other cases the Commission set TACs significantly above the recommended level.

Year	Scientific Advice	Decisions Made	Summary
	For Cod in division 3N and 3O the Scientific Council recommended that there be no directed fishery and that the level of by-catch from other fisheries should be kept to a minimum (page 29).	For Cod in division 3N and 3O the Commission agreed to continue the prohibition on directed fishing (page 88).	
	For Redfish in division 3O the Scientific Council advised it had insufficient data to provide a specific recommendation, however, current fishing levels (13000 tonnes) appeared to be sustainable (page 31).	For Redfish in division 3O the Commission set the TAC at 20000 tonnes (page 87).	
	For Witch Flounder in divisions 2J, 3K and 3L the Scientific Council recommended that there be no directed fishery and that by-catches from other fisheries should be kept at a minimum (page 33).	For Witch Flounder in divisions 2J, 3K and 3L the Commission agreed to continue the prohibition on directed fishing (page 88).	

Year	Scientific Advice	Decisions Made	Summary
	For Northern Shortfin Squid in SA3 and SA4 the Scientific Council recommended a TAC of no more than 34000 tonnes (page 35).	For Northern Shortfin Squid in SA3 and SA4 the Commission set a TAC of 34000 tonnes (page 88).	
2014	From the Scientific Council Report.[813] For Witch Flounder in divisions 3N and 3O the Scientific Council recommended that there be no directed fishery (page 38). For Redfish in divisions 3L and 3N the Scientific Council recommended TAC of between 10200 and 20400 tonnes (page 40).	From the Fisheries Commission Report.[814] For Witch Flounder in divisions 3N and 3O the Commission re-opened the fishery and set the TAC at 1000 tonnes (page 88). For Redfish in divisions 3L and 3N the Commission set the TAC at 10400 tonnes (page 88).	In 2014, as in previous years, the Commission largely followed the advice of the Scientific Council but on occasion departed from this advice without explanation (as in the case of Witch Flounder).

813 Northwest Atlantic Fisheries Organisation, 'Scientific Council Reports 2014' (Northwest Atlantic Fisheries Organisation, 2014).
814 Northwest Atlantic Fisheries Organisation, 'Meeting Proceedings of the General Council and Fisheries Commission for 2014/2015' (Northwest Atlantic Fisheries Organisation, 2015).

Year	Scientific Advice	Decisions Made	Summary
	For American Plaice in divisions 3N, 3L and 3O the Scientific Council recommended that there be no directed fishing and that bycatch should be kept to a minimum (page 43). For Thorny Skate in divisions 3N, 3L and 3O the Scientific Council recommended that there be no increase in catches (approximately 5000 tonnes) (page 46). For American Plaice in division 3M the Scientific Council recommended that there be no directed fishery and that bycatch should be kept to a minimum (page 48).	For American Plaice in divisions 3N, 3L and 3O the Commission agreed that there should be no directed fishing (page 88). For Thorny Skate in divisions 3N, 3L and 3O the Commission set the TAC at 7000 tonnes (page 88). For American Plaice in division 3M agreed that there should be no directed fishery (page 88).	

Year	Scientific Advice	Decisions Made	Summary
2015	From the Scientific Council Report.[815] For Cod in division 3M the Scientific Council recommended that there be a TAC of less than 12425 tonnes for 2016 and 15436 tonnes for 2017 (page 22). For Redfish in division 3M the Scientific Council recommended a TAC of 7000 tonnes (page 25). For White Hake in divisions 3N and 3O the Scientific Council recommended a TAC of 100 – 300 tonnes (page 27).	From the Fisheries Commission Report.[816] For Cod in division 3M the Commission set a TAC of 13931 tonnes (page 81). For Redfish in division 3M the Commission set a TAC of 7000 tonnes (page 81). For White Hake in divisions 3N and 3O the Commission set a TAC of 1000 tonnes (page 88).	In 2015, as in previous years, the Commission largely followed the advice of the Scientific Council but on occasion departed from this advice without explanation (as in the case of Witch Flounder).

815 Northwest Atlantic Fisheries Organisation, 'Scientific Council Reports 2015' (Northwest Atlantic Fisheries Organisation, 2015).
816 Northwest Atlantic Fisheries Organisation, 'Meeting Proceedings of the General Council and Fisheries Commission for 2015/2016' (Northwest Atlantic Fisheries Organisation,, 2015).

Year	Scientific Advice	Decisions Made	Summary
	For Cod in divisions 3N and 3O the Scientific Council recommended that there be no directed fishing and that bycatches should be kept to a minimum (page 29). For Yellowtail Flounder in divisions 3N, 3L and 3O recommended a TAC of less than 26300 tonnes in 2016 and 23600 tonnes in 2017 (page 31).	For Cod in divisions 3N and 3O the Commission agreed that there should be no directed fishing (page 88). For Yellowtail Flounder in divisions 3N, 3L and 3O the Commission set a TAC of 17000 tonnes (page 88).	

North East Atlantic Fisheries Commission

The primary decision making body in NEAFC is the Commission which is made up of all the contracting parties to the NEAFC Convention.[817] Their convention also creates the Permanent Committee on Management and Science (the Management and Science Committee), but this committee does not perform the same functions as other scientific committees within other RFMOs. Instead it organises scientific advice which is provided independently by the International Council for the Exploration of the Sea (ICES).[818] This arrangement is underpinned by a memorandum of understanding between NEAFC and ICES (the ICES MOU) which outlines the responsibilities of each party and the administrative arrangements for the provision of advice.[819]

Within NEAFC the pelagic fisheries are managed on a stock-by-stock basis, but the bottom or deep-water species (with the exception of Rockall haddock) were managed together until 2014.[820] In regards to the pelagic species, the decision making appears to rely primarily on Member States reaching agreement outside of the NEAFC framework. Where the parties do not reach agreement, NEAFC does not appear to be able to act. In these cases NEAFC is less of a decision making framework than a decision endorsement framework.[821] This is concerning as the discussions outside of NEAFC which are not reported, are not public, are not open to observers, and are therefore not transparent.

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817 *NEAFC Convention* (with amendments until 2006), Art 3.
818 *NEAFC Convention* (with amendments until 2006), Art 14.
819 Memorandum of Understanding between the North-East Atlantic Fisheries Comission and the International Council for the Exploration of the Sea, adopted 2007 available at https://www.ices.dk/explore-us/Documents/Cooperation%20agreements/NEAFC/MoU%20NEAFC%20and%20ICES%202007.pdf, ('*ICES-NEAFC MOU*').
820 North-East Atlantic Fisheries Commission, 'Report of the 29th Annual Meeting of the North-East Atlantic Fisheries Commission' (North-East Atlantic Fisheries Commission, 18 April 2010) 2010.
821 North-East Atlantic Fisheries Commission, 'Report of the 28th Annual Meeting of the North-East Atlantic Fisheries Commission' (North-East Atlantic Fisheries Commission, 13 November 2009) 2009, 7-9.

NEAFC has recently had difficulty in passing conservation measures in accordance with scientific advice. In 2007 and 2008 recommendations from ICES, even where not clearly reported, were implemented as conservation measures.[822] In 2010, 2011 and 2012 the Commission failed to reach agreement and therefore failed to implement conservation measures, this was even the case where all delegations reportedly viewed current exploitation of the stock as unsustainable.[823] In 2010 there was clear advice from ICES for the stocks in question, but the Commission could not reach a consensus.[824] In 2011 the Commission again could not reach a consensus; however this time the report made it clear that it was because the Russian delegation disagreed with the scientific advice provided by ICES.[825] Specifically the Russian delegation expressed the view that Russian data and the views of Russian scientists had not been given enough weight and that therefore the resulting advice was the view of only some contracting parties.[826] This disagreement continued into 2012 and 2013 with Russia again advising that they did not agree with the scientific advice of ICES.[827]

A central feature of the scientific method (one that makes scientific advice so useful) is its objectivity, and independent scientific advisors, such as ICES, have more objectiveness. Unfortunately, in the case of the relationship between ICES and NEAFC, objectivity has not lead to either the acceptance of the science by the parties, or more effective implementation of scientific advice into conservation measures. The relationship between NEAFC and ICES is characterised by a lack of responsiveness and coordination, where the advice provided is not directly on point, does not give management options, does not cover all species and is often provided late.[828] In some years too much advice was the problem with the Commission being provided with advice

[822] See table 6 below.
[823] See table 6 below.
[824] North-East Atlantic Fisheries Commission, above n 820, 10.
[825] North-East Atlantic Fisheries Commission, 'Report of the 30th Annual Meeting of the North-East Atlantic Fisheries Commission ' (North-East Atlantic Fisheries Commission, 11 November 2011), 11-13.
[826] Ibid, 13.
[827] North-East Atlantic Fisheries Commission, 'Report of the 31st Annual Meeting of the North-East Atlantic Fisheries Commission' (North-East Atlantic Fisheries Commission, 16 November 2012), 4.
[828] North-East Atlantic Fisheries Commission, above n 821, 7.

on a wide range of stocks not even managed by them.[829] Whether stocks were or were not managed by NEAFC was not made clear in the publically available reporting and is an acknowledged problem.[830] The lack of functionality in this relationship indicates that while objectivity is important for science, unless the science is applied to the problem at hand and able to provide salient advice it appears to be ineffective. Additionally, where there is independence of the scientific advisor, this can lead to members distrusting the advice as Russia did in 2011-2012. This suggests that where Member States have a say in the scientific advice they will have greater ownership and trust in the results.

[829] North-East Atlantic Fisheries Commission, 'Report of the 33rd Annual Meeting of the North-East Atlantic Fisheries Commission' (North-East Atlantic Fisheries Commission, 3-5 September 2014).
[830] Ibid.

Table 6 - The North-East Atlantic Fisheries Commission

This table summarises the recommendations of the NEAFC Committee on Management and Science (the Committee) compared with the decisions by the NEAFC itself (the Commission). It is not intended to include every recommendation of the Committee and every act of the Commission, but rather focuses on those decisions that consider science-based questions. Importantly for NEAFC, the scientific advice is provided by ICES, therefore the Committee is a conduit for independent advice rather than a provider. Advice from ICES that is made directly to the Commission is also be included in this Table. When detailing recommendations or decisions only those that are new are included. The analysis begins in 2007, following the conclusion of the most recent amendments to the NEAFC Convention which, while not yet in force, were used on a provisional basis from that date.

Year	Scientific Advice	Decisions Made	Summary
2007	From the Committee on Management and Science Reports and the published advice of ICES to the Commission.[831]	From the Commission Report.[832]	The Commission put in place a range of conservation measures seemingly on its own initiative without scientific advice. However it is clear

[831] Permanent Committee on Management and Science - PECMAS - of the North-East Atlantic Fisheries Commission, 'Report of the Second Meeting 19-21 February 2007' (North-East Atlantic Fisheries Commission, 19-21 February 2007); Permanent Committee on Management and Science - PECMAS - of the North-East Atlantic Fisheries Commission, 'Report of the PECMAS Meeting, 18-19 October 2007' (North-East Atlantic Fisheries Commission, 19 October 2007); International Council for the Exploration of the Sea, *Advice for NEAFC, 2008* <http://www.ices.dk/publications/library/Pages/List-Search.aspx?k=NEAFC#Default>.

[832] North-East Atlantic Fisheries Commission, 'Report of the 26th Annual Meeting of the North-East Atlantic Fisheries Commission ' (North-East Atlantic Fisheries Commission, 16 November 2007).

Year	Scientific Advice	Decisions Made	Summary
		The Commission set a TAC of 43629 tonnes of Mackerel in ICES areas IIa, V, VI, VII and XII (Annex E, recommendation I). The Commission set a TAC of 14500 tonnes for Redfish in ICES sub-areas I and II (Annex K, recommendation IV). The Commission set a closed area for Rockall Haddock (Annex F, recommendation V) based on previous years scientific advice. The Commission set closed areas to protect vulnerable sea-mounts (Annex I, recommendation VII). The Commission set closed areas to protect deep-sea corals (Annex J, recommendation IX).	that not all recommendations made by ICES were published. Therefore it is unclear if all recommendations were followed and which conservation measures were based on recommendations.

Year	Scientific Advice	Decisions Made	Summary
	The Committee agreed to request advice from ICES on the conservation benefits of limiting shark capture (paragraph 9). The Committee agreed to request advice from ICES on the protection of South West Rockall (paragraph 10). The Committee agreed to a new MOU with ICES in order to clarify the scientific advice provided (paragraphs 5 and 6).	The Commission put in place effort limitations (65% of previous year's effort) for deep-sea fisheries (Annex G, recommendation XV). The Commission set a conservation regime for Orange Roughy, including closed areas and low TACs for those areas not closed (Annex H, recommendation VIII).	

Year	Scientific Advice	Decisions Made	Summary
2008	From the Commission Report.[833] ICES recommended a TAC of between 443000 and 578000 tonnes of Mackerel (page 5). ICES recommended a TAC of 384000 tonnes of Blue Whiting with a need to reduce to this in one year from a higher TAC in 2008 (page 5).	From the Commission Report.[834] The Commission set a TAC of 57884 tonnes of Mackerel in areas outside of national jurisdiction, to give a total catch of 569171 tonnes when combined with national catches. This is at the higher end of the ICES recommendation. (NEAFC Recommendation I 2009, page 1). The Commission set a TAC of 85786 tonnes for Blue Whiting in the Convention Area. This was part of a TAC set by individual nations of over 543043 tonnes. The total TAC while not under the control of NEAFC was not in accordance with ICES recommendations. (NEAFC Recommendation II:2009 page 1)	The NEAFC enacted TACs for its area in accordance with ICES advice. The exception was in the case of Hoarse Mackerel where no measure was enacted. In many cases more precautionary TACs and measures were implemented support fisheries ICES had identified as depleted or at risk but had not specifically advised on. The only TAC which was in excess of ICES such as recommendations was that for Blue Whiting

[833] North-East Atlantic Fisheries Commission, 'Report of the 27th Annual Meeting of the North-East Atlantic Fisheries Commission - Volume 1 Report' (North-East Atlantic Fisheries Commission, 14 November 2008).
[834] Ibid.

Year	Scientific Advice	Decisions Made	Summary
	ICES recommend a starting TAC of 20000 tonnes for Redfish (page 8).	The Commission set a TAC for Redfish in ICES sub-areas I and II of 10500 tonnes within defined fishing seasons. (NEAFC Recommendation IV:2009 page 1) The Commission prevented fishing for Redfish in the Irminger Sea until April 2009. (NEAFC Recommendation III:2009 page 1)	which was set by Coastal States and not NEAFC.
	ICES recommended at TAC of 1643000 tonnes of Herring (page 5).	The Commission acknowledged and endorsed a TAC of 1643000 set by the parties for Herring (NEAFC Recommendation VI:2009 page 1). This was in accordance with ICES recommendations. H.	
	ICES recommended a TAC for Rockall Haddock of 6490 tonnes (page 9).	The Commission prohibited fishing for Rockall Haddock for 2009. (NEAFC Recommendation V:2009 page 1).	

Year	Scientific Advice	Decisions Made	Summary
		The Commission prohibited fishing for Spurdog in response to independent ICES reports that the stock was depleted. The measure was introduced by the EU representative rather than the Scientific Council (NEAFC Recommendation VIII:2009 page 1).	
	ICES recommended a TAC of 180000 tonnes of Horse Mackerel (page 5).	The Commission did not report on Horse Mackerel.	
		The Commission put in place measures (including prohibition of bottom fishing) to protect vulnerable deep-sea habitats. (NEAFC Recommendation XIV:2009 page 1).	
		The Commission set effort limitations for deep-sea fishing (65% of the highest level in the last 4 seasons) (NEAFC Recommendation VII:2009 page 1).	

Year	Scientific Advice	Decisions Made	Summary
2009	From Scientific Committee Report and enclosed ICES advice.[835] ICES recommended a TAC of 540000 tonnes for Blue Whiting in ICES sub-areas I–IX, XII, and XIV (ICES, Blue whiting in sub-areas I–IX, XII, and XIV (Combined stock), ICES Advice 2009, Book 9, page 31). ICES recommended no directed fisheries for the shallow pelagic stock of Redfish (ICES, Redfish (*S.mentella*) in sub-areas V, XII, XIV and NAFO sub-areas 1+2 (Shallow Pelagic stock < 500 m), ICES Advice 2009, Book 2, paragraph 2.4.9). ICES recommended no directed trawl fisheries, protection of juveniles	From the Commission Report.[836] The Commission set a TAC of 78516 tonnes of Blue Whiting in waters beyond national jurisdiction in accordance with an agreement for a TAC in all waters of 497022 tonnes (NEAFC Recommendation I: 2010, page 1). The Commission set a TAC for Redfish in ICES sub-areas I and II of 8600 tonnes within defined fishing seasons (NEAFC Recommendation III: 2010, page 1).	The reporting for 2009 appears to show difficulties in coordination between ICES and NEAFC, in this year fish stocks managed by NEAFC were not included in the ICES presentation with the ICES representative asking for a clear list of stocks that should be included in the presentation. The Commission is highly reliant on coastal and fishing States meeting and reaching agreement outside of the NEAFC framework (for example for Herring) where

[835] Permanent Committee on Management and Science - PECMAS - of the North-East Atlantic Fisheries Commission, 'Report' (North-East Atlantic Fisheries Commisson, 29 September 2009).
[836] North-East Atlantic Fisheries Commission, above n 820.

Year	Scientific Advice	Decisions Made	Summary
	and low by-catch levels for Redfish in sub-areas I and II (Annex G, paragraph 10). ICES recommended a reduction of catch to less than 20000 tonnes for Redfish in the Irminger Sea (Annex G, paragraph 10). ICES advised a TAC of 243000 tonnes for Haddock in sub-area I and II (ICES Advice, Haddock in sub-areas I and II (Northeast Arctic), ICES Advice 2009, Book 3, page 34). ICES advised that the Spurdog fish stock was depleted and that the fisheries should remain closed ICES. Spurdog in ICES areas I – IX, ICES Advice 2009, Book 9, page 92). ICES recommended a TAC of between 4280 and 3330 tonnes for Rockall Haddock (ICES,	The Commission put in place a measure to prevent catch increases for Redfish in the Irminger Sea, the measure also included gear and special restrictions (NEAFC Recommendation II: 2010, page 1-2). Haddock in sub-area I and II was not reported on by the Commission. The Commission prohibited fishing for the Spurdog fish stock (NEAFC Recommendation VII: 2010, page 1). The Commission put in place gear restrictions (fishery only with long-lines) for Rockall	this does not work (for example with Mackerel) NEAFC seemed unable to reach a conclusion (Page 8 Commission Report). ICES advice remains disconnected from NEAFC management priorities, agenda and management areas.

Year	Scientific Advice	Decisions Made	Summary
	Haddock in division VIb (Rockall), ICES Advice 2009, Book 5, page 147).	Haddock (NEAFC Recommendation IV: 2010, page 1). The EU reported that it and Russia had been in discussions about a more comprehensive management measures but were yet to reach agreement. (Annex C – Opening Statement by the European Community).	
	ICES recommended a TAC of between 527000 and 572000 tonnes for Mackerel in the Northeast Atlantic (ICES, Mackerel in the Northeast Atlantic (combined Southern, Western, and North Sea spawning components), ICES Advice 2009, Book 9, page 2).	Mackerel in the Northeast Atlantic was not discussed in the Commission report, except to say that consultations continue (Annex I – Press Release).	
	No advice was provided on Herring by the Committee on Management and Science.	The Commission endorsed a TAC of 1483000 tonnes of Herring (NEAFC Recommendation V: 2010 page 1).	

Year	Scientific Advice	Decisions Made	Summary
	No advice was provided on Orange Roughy by the Committee on Management and Science.	The Commission prohibited fishing for Orange Roughy in ICES areas V, VI and VII and limited fishing outside those areas to 150 tonnes per contracting member (NEAFC Recommendation IX: 2010, page 1).	
2010	From the Committee on Management and Science Report.[837] ICES recommended a TAC for Blue whiting in sub-areas I–IX, XII, and XIV of between 50700 to 223000 tonnes (MSY), or between 0 and 40100 tonnes (precautionary approach) (ICES, Blue whiting in sub-areas I–IX, XII, and XIV (Combined stock), ICES Advice 2010, Book 9, page 77).	From the Commission Report.[838] The Commission set a TAC of 5831 tonnes (as part of a TAC inclusive of national jurisdiction of 36908 tonnes for Blue Whiting in the NEAFC Convention Area (NEAFC Recommendation 1, 2011, page 1).	The Commission failed to reach agreement on Mackerel (therefore leaving it as an open fishery), they also failed to reach agreement on Redfish Irminger Sea but as a result directed fishing for that Stock was banned. ICES recommended that there be no fishing for Redfish in ICES sub-areas I and II

[837] Permanent Committee on Management and Science - PECMAS - of the North-East Atlantic Fisheries Commission, 'Report' (North-East Atlantic Fisheries Commission, 1 October 2010).
[838] North-East Atlantic Fisheries Commission, above n 821.

Year	Scientific Advice	Decisions Made	Summary
	ICES recommended a TAC for Herring in the Northeast Atlantic of 1170000 tonnes (MSY) or 988000 tonnes (precautionary) (ICES, Herring in the Northeast Atlantic (Norwegian spring-spawning herring), ICES Advice 2010, Book 9, page 89). ICES recommended that the TAC for Haddock in ICES sub-areas I and II should be less than 303000 tonnes (ICES, Haddock in sub-areas I and II (Northeast Arctic), ICES Advice 201, Book 3, page 22). ICES recommended a TAC for Haddock in Rockall of less than 2700 tonnes (MSY) or less than 2400 tonnes (precautionary) (ICES, Haddock in division VIb (Rockall), ICES Advice 2010, Book 5, page 149).	The Commission endorsed a TAC for Herring of 988000 tonnes (in accordance with the precautionary limit advised by ICES) for the NEAFC Convention Area (NEAFC Recommendation 5, 2011, page 1). The Commission did not report on discussions of Haddock in sub-areas I and II. The Commission put in place gear restrictions (fishery only with long-lines) for Rockall Haddock (NEAFC Recommendation 4, 2011, page 1).	however a TAC of 7900 tonnes was set, this was over the protests of the EU which said that the decision was a black mark against NEAFC for failing to comply with scientific advice.[839]

[839] Ibid, 11.

Year	Scientific Advice	Decisions Made	Summary
	ICES reiterated its 2009 advice for the shallow pelagic stock of Redfish of that the fishery should be closed (ICES, Redfish (*S.mentella*) in sub-areas V, XII, XIV and NAFO sub-areas I and II (Shallow Pelagic stock < 500 m), ICES Advice 2010, Book 2, page 76). ICES recommended that the fishery for Redfish in ICES sub-area XIVb should not be allowed to expand (above 900 tonnes) (ICES, Redfish (*S.mentella*) in sub-area XIVb (Demersal), ICES Advice 2010, Book 2, page 93). ICES reiterated its 2009 advice for the deep-pelagic stock of Redfish of reducing catch to less than 20000 tonnes (ICES, Redfish (*S.mentella*) in sub-areas V, XII, XIV and NAFO sub-areas I and II (Deep Pelagic stock	The Commission set a TAC for Redfish n ICES sub-areas I and II of 7900 tonnes which was in excess of ICES recommendations (NEAFC Recommendation 3, 2011, page 1). The Commission reported that members could not reach agreement on Redfish in sub-area XIVb (among others) and therefore there would be no directed fishing for the fish through the Convention area for the period of 1 January until 1 April (Annex H). As the Commission could not reach agreement on a TAC they prohibited directed fishing for Pelagic Redfish in ICES sub-areas Va, XII, XIV (including the Irminger Sea) (NEAFC Recommendation 13, 2011 page 1).	

Year	Scientific Advice	Decisions Made	Summary
	> 500 m), ICES Advice 2010, Book 2, page 86).		
	ICES recommended a TAC for Mackerel in the Northeast Atlantic of 672000 tonnes (MSY) or between 592000 and 646000 tonnes (precautionary approach) (ICES, Mackerel in the Northeast Atlantic (combined Southern, Western, and North Sea spawning components), ICES Advice 2010, Book 9, page 47).	The Commission reported that consultations continued in relation to Mackerel (Annex I, page 4).	
	ICES recommended no directed fishery for Orange Roughy in the North East Atlantic. (ICES, Orange Roughy in the Northeast Atlantic, ICES Advice 2010, Book 9, page 211).	The Commission set a TAC of 150 tonnes Orange Roughy for each party (Annex I, page 4).	

Year	Scientific Advice	Decisions Made	Summary
	ICES did not provide advice for Basking Sharks in 2010.	As a protective measure the Commission prohibited directed fishing for Basking Sharks in the NEAFC Convention Area (NEAFC Recommendation 6, 2011, page 1).	
	ICES did not provide advice for Spurdog in 2010.	The Commission prohibited directed fishing for Spurdog in the NEAFC Convention Area and set by-catch protection measures (NEAFC Recommendation 7, 2011, page 1).	
	ICES did not provide advice for Porbeagal in 2010.	As a protective measure the Commission prohibited directed fishing for the Porbeagal in the NEAFC Convention Area (NEAFC Recommendation 8, 2011, page 1).	

Year	Scientific Advice	Decisions Made	Summary
2011	From the Committee on Management and Science Report.[840] ICES recommended that the TAC for Haddock in Rockall should not be more than 3300 tonnes (ICES, Advice June 2011, Haddock in division VIb (Rockall), ICES Advice 2011, Book 5, page 153). ICES recommended a TAC for Norwegian spring-spawning herring of no more than 833000 tonnes (ICES, Advice September 2011, Herring in the Northeast Atlantic (Norwegian spring-spawning herring), ICES Advice 2011, Book 9, page 53)	From the Commission Report.[841] The Commission did not accept advice from ICES on extending the Rockall Haddock closure, questioning the advice itself, but did maintain the current closure (Commission Report, 2011, page 2). The Commission endorsed a TAC for Norwegian spring-spawning herring of 833000 tonnes (NEAFC, Recommendation 3, 2012, page 1)	While all parties noted that the current catch of Mackerel was not sustainable they could not come to an agreement on a sustainable TAC (Commission Report 2011, page 1). However, members did come to an arrangement following the meeting and NEAFC adopted a measure via postal vote on 19 April 2012, unfortunately this measure did not include a TAC (NEAFC,

840 Permanent Committee on Management and Science - PECMAS - of the North-East Atlantic Fisheries Commission, 'Report' (North-East Fisheries Managment Organisation, 4 October 2011).
841 North-East Atlantic Fisheries Commission, above n 825.

Year	Scientific Advice	Decisions Made	Summary
	ICES recommended a TAC of less than 20000 tonnes for Redfish (ICES, Advice September 2011, Redfish (*S.mentella*) in sub-areas V, XII, and XIV, ICES Advice 2011, Book 2, page 12). ICES recommended a TAC for Blue Whiting of 391000 tonnes, in the NEAFC Convention Area (ICES, Advice September 2011, Blue whiting in sub-areas I–IX, XII, and XIV (Combined stock), ICES Advice 2011, Book 9, page 41). ICES recommended a TAC for Mackerel in North-east Atlantic of between 586000 and 639000 (ICES, Advice September 2011, Mackerel in the Northeast Atlantic (combined Southern, Western, and North Sea spawning components), ICES Advice 2011, Book 9, page 5).	The Commission set a TAC of 32000 tonnes for Redfish in the Irminger Sea (sub-areas V, XII, and XIV). The Commission set a TAC for Blue Whiting in the NEAFC Convention Area of 56851 tonnes as part of a larger Coastal State agreed TAC of 359881 tonnes (NEAFC, Recommendation 1, 2012, page 1). The Commission reported that parties could not agree on management measures for Mackerel but agreed that current fishing practices were not sustainable. They reported that the parties were discussing Mackerel outside of NEAFC therefore no management	Recommendation 11, 2012, page 1). The parties could not reach an agreement on management measures for Orange Roughy as they had in the past (Russia and Denmark disagreeing, both said there should be no new measures without new advice, whereas other parties wanted precautionary measures) therefore only general deep-sea measures will apply to that species (Commission Report, 2011, page 2).

Year	Scientific Advice	Decisions Made	Summary
		measures were presented to the meeting (pages 17-18).	The Commission adopted measures for Redfish in ICES sub-areas I and II against the advice of ICES, this is because not all members could agree to a prohibition on directing fishing, and in particular Russia contested the validity of the ICES scientific advice (Commission Report, 2011, page 14).
	ICES advised that there be no directed fishing for Orange Roughy (ICES, Advice June 2011, Orange Roughy in the Northeast Atlantic, ICES Advice 2011, Book 9, page 1)	The Commission reported that there was a stalemate between parties in relation to Orange Roughy and the President of the Commission encouraged parties to try and resolve the issues on the margins of the meeting (page 21).	
	ICES recommended (from 2010) that there be no directed fisheries for Redfish in ICES sub-areas I and II (ICES, Advice June 2011, redfish (*S.mentella*) in sub-areas I and II, ICES Advice 2011, Book 3, page 34)	The Commission set a TAC for Redfish in ICES sub-areas I and II of 7500 tonnes (NEAFC, Recommendation 2, 2012, page 1).	In the 2011 Reports both the Committee and Commission included a list of what had been agreed (or rejected) at the beginning of their report, increasing the
	ICES recommended that there be no directed fishing for Spurdog in the NEAFC Convention Area (ICES, Advice September 2011, Spurdog in the Northeast Atlantic, ICES Advice 2011, Book 9, page 63).	The Commission prohibited the directed fishing for Spurdog in the Convention Area (NEAFC, Recommendation 5, 2012, page 1)	

Year	Scientific Advice	Decisions Made	Summary
	ICES recommended a zero catch for Basking Shark in the NEAFC Convention Area (ICES, Advice October 2011, Basking Shark (*C.maximus*) in the Northeast Atlantic, ICES Advice 201, Book 9, page 111)	The Commission prohibited the direct fishing for deep-sea sharks in the Convention Area (NEAFC, Recommendation 7, 2012, page 1). The Commission prohibited directed fishing for Porbeagle in the Convention Area (NEAFC, Recommendation 6, 2012, page 1). The Commission prohibited the directed fishing for Basking Shark in the Convention Area (NEAFC, Recommendation 4, 2012, page 1)	transparency of their operations.
	ICES advised, that contrary to Russian assertions there was no evidence that supported the conclusion that Redfish formed a single stock and that they would continue to advice on the separate stocks. (ICES, Special Request – Advice 2011, NEAFC request on Redfish stock structure in the Irminger Sea, ICES Advice 2011, Book 2, page 1).	Russia protested the measures for Redfish in the Irminger Sea (which apply 2011 – 2014) therefore the prohibition on directed fishing did not apply to them (Commission Report 2011, page 1). The Russian Federation specifically cited the fact they did not think Russian data had been given sufficient weight in the ICES advice and that Russian scientists were not given sufficient	

Year	Scientific Advice	Decisions Made	Summary
		chance to comment, therefore they said "the [ICES] advice only represented the view of some contracting members" (Commission Report 2011, page 13).	
2012	From the Committee on Management and Science Report.[842] ICES recommended a TAC of 47000 tonnes for Redfish in ICES sub-areas I and II. Some Member States (Russia and Denmark) questioned the ICES advice (PECMAS Report, page 10). ICES recommended a TAC of 643000 tonnes for Blue Whiting (PECMAS Report, page 10).	From the Commission Report.[843] The Commission set a TAC of 19500 tonnes for Redfish in ICES sub-areas I and II (NEAFC, Recommendation 1, 2013, page 1). The Commission set a TAC of 93490 tonnes for Blue Whiting as part of a larger TAC of	The Commission was not able to reach an agreement on management measures relating to the Redfish in the Irminger Sea, with Russia again reiterating its view that the ICES advice was not based on sound science (NEAFC Report, p.4). The Commission again implemented a conservation

842 Permanent Committee on Management and Science - PECMAS - of the North-East Atlantic Fisheries Commission, 'Report' (North-East Atlantic Fisheries Organisation, 5 October 2012).
843 North-East Atlantic Fisheries Commission, above n 827.

Year	Scientific Advice	Decisions Made	Summary
	ICES recommended a TAC of less than 3000 tonnes for Blue Ling and part of its deep-sea species advice (PECMAS Report, page 8). ICES recommended no directed catch for Orange Roughy. Norway questioned why Orange Roughy could not be analysed in this fishery and ICES explained that it was due to a lack of data (PECMAS Report, page 8). ICES recommended a TAC of 20000 tonnes for the deep pelagic stock of Redfish in sub-areas V, XII, XIV (Irminger Sea). Russia disagreed with this advice, saying that it failed to take into account relevant information	591825 tonnes decided by coastal States (NEAFC, Recommendation 16, 2013, page 1). The Commission closed an area to bottom fishing for the protection of Blue Ling in ICES sub-area XIV (NEAFC, Recommendation 5, 2013, page 1) The Commission prohibited directed fishing for Orange Roughy in the NEAFC Convention Area, with a limit of 150 tonnes for each member to cover by-catch and scientific fishing (NEAFC, Recommendation 6, 2013, page 1). The Commission reported that consultations among the parties on Redfish had been unsuccessful (page 4). The Commission could not agree to a management proposal put forward by Russia for Redfish in the Irminger	measure for Mackerel that did not include a TAC (NEAFC, Recommendation 2, 2013, p.1-2) The Commission failed to implement measures for the deep pelagic stocks of Redfish. This year the Scientific Committee included a complete account of the ICES advice provided and the comments made on the advice by the members of Scientific Committee. This approach increased transparency by including all

Year	Scientific Advice	Decisions Made	Summary
	(PECMAS Report, page 9). ICES recommended no directed fishing for the shallow pelagic stock of Redfish in sub-areas V, XII and XIV (Irminger Sea) (PECMAS Report, page 9). ICES recommended a TAC of 619000 tonnes for Norwegian spring-spawning Herring (PECMAS Report, page 11). ICES recommended a TAC of between 497,000 and 542,000 for Mackerel (PECMAS Report, page 11).	Sea (page 5). These consultations were in relation to both deep and shallow stocks. The Commission Report noted that negotiations between the parties for a TAC for Norwegian spring-spawning Herring had not been successful and therefore no management measure would be presented to the meeting (page 6). The Commission Report noted that negotiations between the parties on a TAC for Mackerel had not been successful and therefore management measures would reflect only the areas of consensus not including a TAC (page 6).	the scientific advice in one area.

Year	Scientific Advice	Decisions Made	Summary
	This year ICES moved from providing general advice on deep-sea species to providing advice on individual stocks.	The Commission put in place an effort limit of 65% of previous years for fishing for deep-sea species in the NEAFC Convention Area (NEAFC, Recommendation 4, 2013, page 1). This followed discussions on how to deal with the new formulation of ICES advice on individual stocks which had come as a surprise to the Commission (pages 6 and 7).	
2013	From the Committee on Management and Science Report.[844] For Mackerel in the convention area ICES recommended a TAC of 889886 tonnes (page 2).	From the Commission Report.[845] For Mackerel the Commission did not set a TAC as they were awaiting consultations between coastal States (paragraph 10.5).	This year the Commission adopted measures in accordance with ICES advice for all stocks with the exception of Redfish in the Irminger Sea where the parties could not agree. This was because Russia did not

[844] S. Palmason, 'Report of the Permanent Committee on Management and Science (PECMAS) ' (North-East Atlantic Fisheries Commission, 2-4 October 2013).
[845] North-East Atlantic Fisheries Commission, '32nd Annual Meeting of the North-East Atlantic Fisheries Commission' (North-East Atlantic Fisheries Commission, 11-15 November 2013).

Year	Scientific Advice	Decisions Made	Summary
	For Blue Whiting in the convention area ICES recommended a TAC of 948950 tonnes (page 2). For Norwegian Herring in the convention area ICES recommended a TAC 418487 tonnes (page 2). For deep pelagic Redfish in the Irminger Sea ICES recommended a TAC 20000 (page 2). For shallow pelagic Redfish in the Irminger Sea ICES recommended that there be no directed fishing (page 2).	For Blue Whiting the Commission did not set a TAC as they were awaiting consultations between coastal States (paragraph 10.3). For Norwegian Herring the Commission did not set a TAC as they were awaiting consultations between coastal States (paragraph 10.4). For Redfish in the Irminger Sea the Commission could not reach an agreement as Russia did not believe the ICES advice was based on sufficiently rigorous science. However the previous interim measures remained in force which equalled a TAC of 20000 tonnes. Unfortunately Russia had objected to the interim measures and therefore was not bound by them, Russia had instead declared a unilateral TAC of 23700 tonnes (paragraph 10.1).	agree with the proposed measures nor the interim measures in place. While this is unfortunate for the Redfish stock, it was transparently explained in the report with both the scientific advice and management discussions reported.

Year	Scientific Advice	Decisions Made	Summary
	For Redfish in areas I and II ICES recommended a TAC of 24000 tonnes (page 2). For Rockhall Haddock ICES recommended a TAC of not more than 1620 tonnes (page 2).	For Redfish in areas I and II the Commission adopted a TAC of 24000 tonnes (Annex H). The Commission prohibited all fishing, except for with long-lines in this area (paragraph 10.6).	
2014	From the Committee on Management and Science Report.[846] For deep water Redfish in the Irminger Sea ICES recommended a significant reduction in catch levels (Annex 1).	From the Commission Report.[847] For deep water Redfish in the Irminger Sea the Commission set the TAC at 9500 tonnes (Annex L). For shallow water Redfish in the Iminger Sea	While this year it appeared that the Commission adopted conservation measures based on all ICES recommendations it was difficult to tell. The ICES recommendations were clear

[846] E. Shamray, 'Report of the Permanent Committee on Management and Science (PECMAS)' (North-East Atlantic Fisheries Commission, 3-5 September 2014).
[847] North-East Atlantic Fisheries Commission, above n 829.

Year	Scientific Advice	Decisions Made	Summary
	For shallow water Redfish in the Iminger Sea ICES recommended that there be no directed fishing (Annex 1). For Rockall Haddock ICES recommended a TAC of 4310 tonnes (Annex 1). ICES provided advice on how to protect vulnerable marine ecosystems (pages 3 and 4). Roundnose Grenadier ICES recommended a TAC of less than 4595 tonnes (Annex 1)	the Commission determined that there should be no directed fishery until a recovery plan was in place (Annex L). For Rockall Haddock the Commission prohibited all fishing except for with long-lines (Annex L). For Deep-Sea fisheries the Commission required that State parties keep fishing effort at 65% of the previous year's maximum effort (Annex L). This was a renewal of previous conservation measures. For Roundnose Grenadier the Commission set a TAC of 717 tonnes (Annex L). For Roughhead Grenadier the Commission set a TAC of 900 tonnes (Annex L).	when presented however it was difficult to tell which recommendations were relevant to NEAFC. There continues to be a difference between the stocks advised on and the stocks that need to be managed by ICES.

Year	Scientific Advice	Decisions Made	Summary
	PECMAS provided an information pack to the Commission on deep water species. It was not forwarded as a recommendation because the EU did not support it (Annex 1).	For Basking Shark the Commission decided that there would be no directed fishery (Annex L). For Porbeagle the Commission decided that there would be no directed fishery (Annex L). For Spurdog the Commission decided that there would be no directed fishery (Annex L). The Commission adopted the protections for vulnerable marine ecosystems as recommended by PECMAS (Annex L).	

Summary: Scientific Reports to Final Decision

None of the RFMOs examined automatically turn scientific recommendations into binding conservation measures. In each case there is a decision making process that examines and analyses the scientific advice before conservation measures are enacted, often in a form modified from that recommended within the scientific advice. All the RFMOs consider science and all have some mechanism for scientific information to be provided to the decision makers. A sign of the importance of science in decision making in too many of the commissions or councils is that they find it extremely difficult to make decisions in the absence of scientific advice or consensus scientific advice. Where science was not present these decision makers either could not reach consensus themselves or could not devise appropriate measures. There are exceptions of course, notably CCAMLR, where the Commission has routinely enacted measures in the absence of science or scientific consensus on the basis of the precautionary principle. It is telling that there were no examples of reported decisions being made, in the absence of science, based on: economics, social factors or politics. All of these factors would be reasonable inputs into decision making but none were used or discussed in reports. Unfortunately, the presence of scientific consensus did not always assist decision making and in all the RFMOs examined, the Commission's made decisions to implement measures in excess of or even contrary to scientific advice. In these cases, more often than not, no reason for the divergence was discussed.

The lack of transparency in reporting of decision making was consistent across RFMOs. It was very rare that an RFMO report would identify all the scientific recommendations provided, the discussion of that recommendation, and the reasons for the final decision. Often reports failed to identify scientific recommendations (except those that were acted upon) or did not discuss the reasons why decisions were made. Where a reason was provided it was normally a general statement as to the lack of consensus or a disagreement in relation to the fidelity of the science.

Often, even where all information was provided within a report, the structure of the report made it difficult to compare scientific recommendations to implemented conservation measures. Where reports were structured to give this clarity, it was often in relation to scientific advice that was implemented by decision makers.

In the RFMOs examined scientific advice was generally provided by a scientific committee made up of representatives of the Member States, except in the case of NEAFC where scientific advice was provided by ICES, an independent organisation. The scientific advice provided was rarely criticised in RFMO reports, and where it was, it was generally one or two Member States arguing that the science or the model was wrong because it (they) did not reflect the data that they had nationally. These disputes occurred with both the advice provided through scientific committees and the advice provided by ICES. Neither independent advice nor democratically crafted science appears to circumvent those problems, but it appears that salient advice, provided at the right time, in a transparent manner, is more effective in leading to conservation measures.

All the RFMOs examined legally required that decision making bodies make their decisions based on science.[848] Unfortunately, despite this clear legal requirement, that RFMOs found it difficult to implement measures with scientific consensus. The legal requirement for decisions to be based on science was not enough to ensure that RFMOs were able to effectively implement effective conservation measures to be able to meet their mandated aims of sustainable use of fish stocks. The following chapter will examine how legal structures could otherwise assist and support the decision making process within RFMOs.

[848] McDorman, above n 64, 434.

Chapter 6

Legal Structures and Decision making based on Science

Within RFMOs there is a multi-step mechanism to decide and implement management measures. Scientific (and other) advice is provided to a decision making body, it is discussed, the decision making body decides on conservation measures and then the conservation measures, and where they are adopted, they are then implemented by the Member States. This process happens within a legal framework, both the overarching framework of international fisheries law and the specific legal framework of the relevant RFMO. The relevant legal framework shapes and guides the decision making process, including how that process uses scientific information, and therefore features of that framework can also modify the effectiveness of the decision making process. In each of the RFMOs examined there were occasions where management measures failed to be implemented due to a lack of scientific consensus or advice and still other occasions where measures were implemented contrary to scientific advice. Yet there were also examples where RFMOs were able to implement measures based on scientific advice and were still willing to act even where that advice was absent.

This chapter will analyse how the features of an RFMO's legal framework influence the effectiveness of science within the RFMO's decision making process. It will aim to find those features that are already included in legal frameworks that are conducive to the effective use of scientific information. Additionally it will look to the practice and policy of RFMOs and try to uncover principles that could be included in all legal frameworks and which would improve the way RFMOs use scientific information. It will draw on both the comparisons elaborated within chapter five, and the literature dealing with the interactions between science and management that are elaborated in chapters one and two. The aim is to explain what factors influence the effectiveness of decision making within the RFMO and why it is so. All RFMOs examined contain a provision either requiring that their decisions are to be based on the 'best scientific evidence available' or 'based on the advice of the scientific committee'. Although this should theoretically ensure that all RFMOs base every decision on science, this is not the case and therefore legal arrangements must be more sophisticated in assisting the use of science in decision making. The following discussion will focus on key areas where legal provisions may be able to assist RFMOs in making effective use of scientific information, namely: objectives, provision of scientific advice, decision making procedures, inputs into decision making, and transparency and accountability.

Objectives

It is the realm of management and politics to determine goals and objectives for RFMOs. For these disciplines to succeed, they must create objectives that are specific enough to give scientific advisors a goal they can guide managers to achieve, yet not so specific that the goals become outdated. To solve this dilemma RFMOs have two tiers of political decision making: the overarching objectives and structure of the organisation which are included in the RFMO's agreement text and the council or commission, that meets on a regular bases and which can re-determine whether the objectives should be subject to change. The commission or council may make its decisions in the heat of a problem (such as a dramatic stock collapse).

Nearly all multilateral conventions contain some statement of objective. Article 2 of the 1958 *CFCLR* has the very specific, 'optimum sustainable yield', explaining that this was to secure the 'maximum supply of food and other marine products'.[849] The *LOSC*, at preamble paragraph four, provides for "the equitable and efficient utilisation of ocean resources, the conservation of their living resources and the study, protection and preservation of the marine environment".[850] This is further articulated in Article 61 of *LOSC*, which specifies that the aim of fishery management will

[849] *CFCLR*, Art 2.
[850] *LOSC*, preamble.

be the production of MSY, as qualified by other environmental or economic factors.[851] The balance between the right to use and the obligation to protect is further expanded upon in *LOSC* Articles 192-193, they make it clear that the right to use a resource (Article 192) is only exercisable "in accordance with [the] duty to protect and preserve the marine environment" (Article 193). Although these articles relate to the protection of the marine environment in general it is clear that the conservation of marine living resources is an element of the protection of the marine environment.[852] The Code of Conduct in keeping with the principles of the 1992 *Rio Declaration* states that the aspiration of management is for intergenerational equality and ecosystem sustainability.[853] Finally the most recent UN agreement, the *UNFSA,* states that the objective of management is to "ensure the long-term conservation and sustainable use of the straddling fish stocks and highly migratory fish stocks".[854] The wording in these agreements, general as it is, show a gradual evolution in the political consensus on what the objectives of management should be, from a purely economic outlook in 1958, to a requirement to consider long-term conservation and sustainable use in 1995. Yet, in all cases the requirements only give a broad direction to those who manage fisheries. There is still much room for debate on what the aim should be in managing a particular species or a particular area, and then it is left to RFMOs to reach political consensus on management.

The CCAMLR declares its purpose to be "the conservation of marine living resources", including the "rational use" of those resources.[855] CCAMLR further contains the most detailed objectives of any RFMO in Article II (3) which provides the objective of management as:

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851 *LOSC*, Art 61.
852 *Southern Bluefin Tuna Order of 27 August 1999 (New Zealand v. Japan; Australia v. Japan)* (*Provisional Measures)* (1999 ITLOS Reports 280, para 70.
853 *The FAO Code of Conduct*, Art 6.2.
854 *UNFSA*, Art 3.
855 *CAMLR Convention*, Art II.

(a) prevention of decrease in the size of any harvested population to levels below those which ensure its stable recruitment. For this purpose its size should not be allowed to fall below a level close to that which ensures the greatest net annual increment;

(b) maintenance of the ecological relationships between harvested, dependent and related populations of Antarctic marine living resources and the restoration of depleted populations to the levels defined in sub-paragraph (a) above; and

(c) prevention of changes or minimisation of the risk of changes in the marine ecosystem which are not potentially reversible over two or three decades, taking into account the state of available knowledge of the direct and indirect impact of harvesting, the effect of the introduction of alien species, the effects of associated activities on the marine ecosystem and of the effects of environmental changes, with the aim of making possible the sustained conservation of Antarctic marine living resources.

While these goals are no doubt difficult to implement and require an ecosystem approach to understanding and managing the fishery, they are specific; they contain goals that are measurable and are temporally bound, everything required to ensure scientists do not need to stray into the realm of politics. Other RFMO agreements examined do not provide this level of detail.

The GFCM provides that the purpose of management is the "rational management and best utilisation of living marine resources".[856] SEAFO's objective is the "long-term conservation and sustainable use of fisheries".[857] NAFO's objective is to contribute to the "optimum utilisation and conservation of fishery resources".[858] Likewise, NEAFC has as its objective "the long-term conservation and optimum utilisation of fishery resources".[859] The NEAFC agreement contains additional information in a later Article, namely that the commission must:

apply the precautionary approach; take due account of the impact of fisheries on other species and marine ecosystems, and in doing so adopt, where necessary, conservation and management measures

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[856] *GFCM Convention* (as amended until 1997), Art III.
[857] *SEAFO Convention*, Art II.
[858] *NEAFC Convention* (with amendments until 2006), Art II.
[859] *NAFO Convention*, Art 2.

> that address the need to minimise harmful impacts on living marine resources and marine ecosystems; and take due account of the need to conserve marine biological diversity.[860]

While these additional parameters are beneficial they do not give the same level of measurability that the objectives within the CCAMLR text provide. The SPRFMO convention initially takes a similar approach to NEAFC, where Article 2 of the SPRFMO convention sets out its objectives "as ensuring the long-term conservation and sustainable use of fisheries resources and the safeguarding of the marine ecosystem, through the use of precautionary and ecosystem approaches to management".[861] However, use of the precautionary and ecosystem approach is further elaborated in later Articles and, like the CCAMLR text, includes measurable objectives. In particular Article 20 of the SPRFMO convention states that the Commission should adopt measures to:

> (a) ensure the long-term sustainability of fishery resources and promote the objective of their responsible utilisation;
>
> (b) prevent or eliminate over fishing and excess fishing capacity to ensure that levels of fishing effort do not exceed those commensurate with the sustainable use of fishery resources;
>
> (c) maintain or restore populations of non-target and associated or dependent species to above levels at which their reproduction may become seriously threatened; and
>
> (d) protect the habitats and marine ecosystems in which fishery resources and non-target and associated or dependent species occur from the impacts of fishing, including measures to prevent significant adverse impacts on vulnerable marine ecosystems and precautionary measures where it cannot adequately be determined whether vulnerable marine ecosystems are present or whether fishing would cause significant adverse impacts on vulnerable marine ecosystems.

The same Article goes on to describe the use of reference points providing that conservation measures will include:

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[860] *NAFO Convention*, Art 4(2) c-d.
[861] *SPRFMO Convention*, Art 2.

a) reference points, including precautionary reference points as described in Annex II of the 1995 Agreement [(*UNFSA*); and]

(b) the actions to be taken if those reference points are approached or exceeded.

In the RFMOs examined there are essentially three approaches to the setting of management objectives in the legal text. There is the approach of using the objectives as set out in the multilateral treaties, and providing only minimal additional guidance if any. This is the approach taken in the GFCM, SEAFO and NAFO conventions. Alternatively, there is the approach of NEAFC to use the objectives of the multilateral conventions, but to also provide additional general guidance on how that is to be achieved. Finally there is the 'best-practice' approach, found in CCAMLR and SPRFMO, of including both amplifying guidance to the general objectives, and measurable goals such as reference points.

This thesis, for those RFMOs examined, has confirmed other reviews in finding that CCAMLR is the RFMO that most effectively uses science.[862] Not only was CCAMLR unlikely to implement measures contrary to or in excess of scientific advice, but it would also implement management measures in the absence of scientific advice or consensus. CCAMLRs effectiveness in using scientific information is partly enabled by the specific objective found within the CCAMLR text, the specificity achieved within the convention allows for scientific advice to be provided with less political interference. In the other RFMOs, particularly NEAFC, and GFCM, politics played a much greater role in both decision making and the use of science. In NEAFC, decisions were largely made by diplomatic means outside the treaty system, while in GFCM there was often no consideration of scientific advice for unreported reasons. In all the remaining RFMOs (excluding SPRFMO), there was a more limited ability for the commission to agree in the absence of scientific advice. Decision making in these organisations centred on what the reference points for

[862] Lodge et al, above n 9, 135-139.

management of fish stocks should be, (a discussion already determined for CCAMLR in its convention text), rather than the measures needed to meet the objectives of the various States or economic interests.

The Provision of Scientific Advice

In all RFMOs there is a recognition within the legal framework that decisions should be based on the best scientific evidence available, however, the structure in which that scientific evidence is provided differs between the RFMO. All fall along a spectrum. At one end, States parties provide loosely coordinated scientific data and advice, in the middle of the spectrum States pool resources to have scientists work under the direction of a central secretariat or committee, and at the far end of the spectrum there can be the complete outsourcing of scientific advice to an independent organisation.

There is little guidance on how RFMOs should organise the provision of scientific advice in multilateral treaties. Articles 7 and the 8 of the *CFCLR* speak of "appropriate scientific findings" and 'scientific reasons', but provide nothing further on the best structure to develop those findings or reasons. Likewise, Article 61 of the *LOSC* (referring to fisheries within the EEZ) requires States to "[take] into account the best scientific evidence available" but not how to obtain this. The Code of Conduct states at Article 12.13 "States should promote the use of research results as the basis for the setting of management objectives, reference points and performance criteria, as well as ensuring adequate linkage, between applied research and fisheries management", but like the other agreements does not talk about the structure in which research results are best provided to managers. Article 10 (d) of the *UNFSA* provides that a function of a RFMO is to 'obtain and evaluate scientific advice, review the status of stocks and assess the impact of fishing on non-target and associated or dependent species'. Article 10 (g) of *UNFSA,* does give some slight direction, it requires that RFMOs "promote and conduct scientific assessments of the stocks and relevant research and disseminate the results thereof".

These treaties all suggest that management measures should be based on the best scientific evidence available in order to achieve the objectives stated in the various conventions. They also provide that RFMOs have as a role the coordination and encouragement of science among their members. The *UNFSA* alone of the multilateral treaties suggests that it should be the RFMO, as a body, which conducts the science, rather than leaving it to individual members.[863] The flexibility within the relevant discussed agreements is beneficial; it grants the ability for RFMOs to have science provided to them in the most effective manner possible, unshackled from legal requirements which may become outdated. The literature on the use of science in decision making suggests that in order to effectively contribute to decision making, the science provided must be seen as legitimate; that is it should be provided in a way that has credibility, independence, and transparency.[864] Additionally, the literature shows, that in order to effectively influence decision makers, scientific advice must be salient; that is relevant and responsive to the needs of decision makers.[865] Therefore, the most effective sources of scientific advice will have expertise, be independent, will arrive at its conclusions in a rigorous but democratic way, be responsive to the needs of the decision making body, and provide advice in a manner that makes it credible for all parties in the RFMO. These criteria are elaborated below *vis a vis* the subject RFMOs.

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[863] *UNFSA* Art 8(3) and Art 10(d-g), note particularly that Article 10 refers to the functions of regional or sub-regional organisations and arrangements.
[864] See chapter 2 above.
[865] See chapter 2 above.

Independence and Responsiveness

CCAMLR is accepted as one of the most effective fisheries managers and scientific advice is more consistently followed than in any other subject RFMO examined.[866] The Scientific Committee of CCAMLR was established within the Convention itself as a decision making body with representatives from all members of the decision making Commission which provides democratic legitimacy to the advice provided.[867] The Scientific Committee takes into account both the outcomes of research from the national programs of members and the results of a number of programs managed by the Scientific Committee itself. A large number of scientists support the work of the Scientific Committee, members send representatives to both the main Scientific Committee meetings and the meetings of the working groups. In addition the CCAMLR Secretariat has a number of scientific personnel who support the Scientific Committee.[868] The specific purpose of the Scientific Committee is established in Article XV of the CCAMLR, which provides that the body is a forum for consultation and cooperation, and should encourage and promote cooperation in the field of scientific research. Importantly, that same Article provides further elaboration stating that the SC-CAMLR "shall conduct such activities as the Commission may direct" (thus ensuring its responsiveness to the Commission), and is to:

> a. establish criteria and methods to be used for determinations concerning the conservation measures referred to in Article ix of this Convention;

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866 McDorman, above n 64, 434.

867 The rules of procedure for the CCAMLR Scientific Committee provide that recommendations of the committee are to be based on consensus, but where this cannot be achieved that the report must set out all views presented. This ensures that while representative the work of the committee cannot be frustrated by a disagreement or divergence, common to science, or political maneuvering. It is also an important tool in support of transparency. CCAMLR, *Rules of Proceedure for the Scientific Committee*, originally adopted at CCMALR-II (9 September 1983), available at https://www.ccamlr.org/en/document/publications/rules-procedure-scientific-committee, Rule 3.

868 CCAMLR, *Staff List* <https://www.ccamlr.org/en/organisation/staff-list>.

b. regularly assess the status and trends of the populations of Antarctic marine living resources; analyse data concerning the direct and indirect effects of harvesting on the populations of Antarctic marine living resources;

c. assess the effects of proposed changes in the methods or levels of harvesting and proposed conservation measures;

d. transmit assessments, analyses, reports and recommendations to the Commission as requested or on its own initiative regarding measures and research to implement the objective of this Convention;

e. formulate proposals for the conduct of international and national programs of research into Antarctic marine living resources.

These additional responsibilities provide for a scientific body that not just coordinates scientific research and presents findings, but also independently conducts its own research and analysis. Although the Scientific Committee is comprised of representatives, the legal framework suggests that it is as a body corporate. That is, it is independent, with a duty beyond simply representing the individual research of Member States. While the Scientific Committee is made up of representatives, the aim is to make the work of the committee and subgroups as independent as possible. Given CCAMLRs position as a leader in science based fisheries management, and the results of the analysis in this thesis showing that scientific recommendations effectively lead to conservation measures, it can be assessed that this balance of representativeness, independence and responsiveness, is an effective way to produce advice that is both legitimate and salient to decision makers.

The SPRFMO is a new organisation and as such its efficiency in using science has not yet been tested, but its legal framework makes for useful observation as it was drafted with the benefit of understanding which RFMO frameworks were proving most effective. Like CCAMLR, SPRFMO has a Scientific Committee which is created by the SPRFMO Convention at Article 6(2)(c). Article 10 of the SPRFMO (modelled on CCAMLR) creates a Scientific Committee that is representative (one representative from every member of the Commission) and has specifically detailed functions. Those functions, listed in Article 10(2), clearly articulate a scientific committee that is to produce its own science and analysis instead of simply coordinating the scientific work of individual States. In addition to stock assessments it includes: providing reference points in accordance with *the UNFSA* (Article 10(2)(b)(i) *SPRFMO Convention*), doing analysis of conservation and management alternatives including estimates of the extent each strategy would achieve the objective of management (Article 10(2)(b)(iii)), and providing advice on the impact of fishing on the marine ecosystem, including vulnerable marine ecosystems ((Article 10(2)(c)). Article 10(2)(a) provides that a function is to:

> plan, conduct and review scientific assessments of the status of fishery resources including, in cooperation with the relevant coastal State Contracting Party or Parties, fishery resources that straddle the Convention Area and areas under national jurisdiction.

Given that the text expressly *includes* cooperation with relevant parties, it is clear that it is primarily focused on the independent planning, conduct and review of scientific fish stock assessments. The work of the Scientific Committee is not to be completely independent of the work of Member States. Thus, it is clearly envisaged that data collected by Member States will be used in analysis and Article 23 requires the development of procedures and mechanisms that are necessary for data sharing. In addition to promoting independence, the specific detail included in the Convention text improves the probability that the work of the committee will be independent of the political process within the Commission and that the advice will focus on science. It also ensures that the work of the Scientific Committee is focused on tasks that science can assist with, rather than being asked to undertake tasks (such as deciding on management objectives) that are better decided by politics, rather than science.

The Scientific Committee of SEAFO is created by Article 5 of the SEAFO convention. The Scientific Committee is representative, with one representative from each member of the SEAFO

Commission participating.[869] The SEAFO Convention sets out in detail the functions of the Scientific Committee. Articles 10(3) and 10(4) detail functions that include: providing the SEAFO Commission with scientific advice for conservation and management measures; establishing criteria and methods to be used in determining conservation and management measures; assessing status and trends, analysing data on the effects of fishing and assessing the effectiveness of proposed conservation measures. Compared to the CCAMLR, there is a greater emphasis in the SEAFO Convention on the cooperation and coordination role of the scientific committee.[870]

The GFCM convention, at Article VII, provides that the Commission can establish subsidiary bodies, the establishment of such bodies is at the discretion of the Chairman of the Commission, the Director-General of GFCM, and the Secretary of the Commission. Through this mechanism the GFCM Scientific Advisory Committee is not created by the Convention text, but rather by the Commission. The mandate Scientific Advisory Committee is to provide independent scientific advice on fisheries conservation and management, including biological, social and economic aspects.[871] In order to provide this advice there are a number of functions ascribed to the Scientific Advisory Committee that are similar to those given to the scientific bodies of SEAFO and CCAMLR, but they, like the establishment of the Scientific Advisory Committee itself, are not enunciated in the legal text. The creation of the Scientific Advisory Committee and the description of its functions outside of legal texts inevitably leads to less independence than the scientific bodies for CCAMLR, SPRFMO and SEAFO enjoy.

The Scientific Advisory Committee not only deals with biological science but also social and economic sciences. While economics and social science are vital to the work of fisheries management, the methodology, expertise and focus of those disciplines is vastly different to that

869 *SEAFO Convention*, Art 10(1).
870 *SEAFO Convention*, Art 10(3) and Art 10(4)(a).
871 General Fisheries Commission for the Mediterranean, above n 751.

of the biological sciences. This means that it does not have the same advantages as purely scientific bodies, it cannot always lay claim to the objectiveness of the scientific method, or compliance with the multilateral treaties which require management based on science. It also impacts on the independence of the committee, the broad remit, rather than specifically defined functions, and allows for greater outside interference with the committees work. The lack of independence is highlighted by the very detailed, and limiting, directions given to the Scientific Advisory Committee from the GFCM Commission, an example is the 26th meeting of the GFCM where the Commission's request to the Scientific Advisory Committee included the direction to use charts and to include lists of bibliographies in its work.[872] While these matters may appear trivial, they serve to highlight the level of control the Commission exercises over the work of the Scientific Advisory Committee.

The problems faced by the Scientific Advisory Committee are largely because the GFCM Convention does not create a Scientific Advisory Committee with defined functions that are separate to the Commission. Indeed it is the Commission, but with the added responsibility for scientific action. Thus, Article III (e) provides that it is a function of the Commission "to encourage, recommend, coordinate and, as appropriate, undertake research and development activities, including cooperative projects in the areas of fisheries and the protection of living marine resources". Clearly, this is a role normally undertaken by a purely scientific body, rather than one that also has responsibility for the formulation and implementation of conservation measures. This conflation leaves science much less independent, and certainly from the assessment of science in GFCM described in chapter five of this thesis, much less effective.[873]

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872 The Food and Agriculture Organization, 'The General Fisheries Commission For the Mediterranian; Report of the Twenty-Sixth Session' (2001), Annex G.
873 See pages 280-336 in this thesis.

In NAFO, the Scientific Council is created by Article VII of the NAFO Convention and it is a representative body. The functions of the Scientific Council are listed at Article VII (8) of the Convention, which provides at sub-section (e) that one of the functions of the council is to "provide scientific advice to the Commission as required by the Commission" and at Article VII (10) to provide advice to coastal States upon request". This suggests a role for the Scientific Council that is independent of, but subservient to, the Commission. Independence of the Scientific Council is supported by Article VII (9), which allows the council to provide advice on its own initiative to the commission. Contrarily Article VII (8) Sub-Articles a – d focus largely on coordination and cooperation of the work of States, which suggests that there is not an independent scientific body, but simply a methodology for coordinating the science of Member States. This is further inferred from the duties of coastal States listed at Article X(1)(d-e) which include such activities as biological sampling, collecting and exchanging scientific data, and, exchanging any other information. The duties of the Scientific Council are, however, limited to matters of science, Article VII (10)(a-b) limits advice to 'scientific advice' on the 'scientific basis for the conservation and management of fisheries resources'. In NAFO the lack of legal structural independence of the Scientific Council from States has not crossed into the functioning of the body. The Scientific Council rarely had problems coming to agreement on appropriate TACs and other conversation measures even where there were political disagreements on the same measures within the Commission.[874] Importantly demonstrating that the members of the Scientific Council have sufficient independence from political masters to be able to give scientific advice, even where the States that those members represent do not agree with it for non-scientific reasons.

[874] See pages 338-339 in this thesis.

NEAFC has the most independent scientific advisory mechanism of all the RFMOs examined. While NEAFC does have a Permanent Committee on Management and Science (Committee on Science), this body does not create or analyse scientific data on behalf of members. Rather it manages contact with the international organisation, the International Council for the Exploration of the Sea (ICES), which is contracted, by a MOU (ICES-NEAFC MOU), to provide scientific advice to NEAFC. Heck highlights the benefits of the use of ICES compared to the use of national scientists. He points out that the use of ICES has long been supposed to add to the neutrality and perceived objectiveness of the science used for management decisions.[875]

The Committee on Science is created in the NEAFC Convention at Article 3(8), and the relationship with ICES is also set down in Article 14. That Article states that the Commission will seek advice from ICES on the biology, population dynamics, state, reaction to exploitation, and measures for conservation and management, of fish stocks.[876] Article 16 requires State parties to provide fisheries data to NEAFC, so that it can be passed to ICES. The arrangements between NEAFC and ICES are set out in the ICES-NEAFC MOU which states at paragraph 1:

> ICES according to this Memorandum of Understanding will provide NEAFC with scientific information and advice, which is independent and free from political influence...

The arrangement for provision of scientific advice at NEAFC preserves independence, yet this independence has arguably not increased the effectiveness of the scientific advice. Scientific advice to NEAFC is followed no more than in other RFMOs (and in comparison with CCAMLR, even less). In addition the work of NEAFC has been less effective in creating conservation and management measures because it has on occasion not had the scientific advice that it requires. This is a problem of responsiveness. That is, the mechanism for scientific advice does not provide

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875 C. Heck, 'Collective Arrangements for Managing Ocean Fisheries' (1975) 29(3) *International Organization* 711, 731-739.
876 *NEAFC Convention*, Art 14(1).

the information required for decision making. Problems in communication between ICES and NEAFC have led to advice arriving late or in some cases not at all. At the 2008 meeting, ICES representatives made it clear that the organisation was not fully aware of what stocks NEAFC wanted scientific advice for, or recommendations on. Further exasperating this problem is that much of the decision making at NEAFC occurs between States outside of regular meetings. Thus TACs are determined by negotiation, State to State, before being reported to NEAFC to be rubber stamped. The decision making that occurs between meetings happens without the benefit of the advice provided by ICES at the NEAFC meeting itself. Given the experience of NEAFC and the problems that are evident from its yearly reporting it is clear that any structure for providing scientific advice must be attuned to the relevant decision making body, or at least to such an extent as to provide advice at a time and place that will allow it to be used in the decision making process.

There are a variety of methods used for provision of scientific advice to decision makers within RFMOs. Some RFMOs, such as IATTC, employ a full scientific staff under the supervision of a director of investigations to carry out all scientific research and analysis on behalf of the commission.[877] At the end of the spectrum, some RFMOs rely on panel's national representatives to provide scientific analysis yet there is a danger in this system of scientific advice becoming politicised. In the middle of these two methods is the use of the scientific committee, composed of national representatives, but which also employs independent scientific experts to provide the basic impartial scientific data and advice.[878] It is this compromise of national representation and scientific independence which is most prevalent among the RFMOs examined and it appears more effective than complete independence. This is most strikingly shown by comparing the influence of scientific information in CCAMLR with its mixed system, compared to the influence of science

[877] Heck, above n 875, 725-733.
[878] Lodge et al, above n 9, 32-33.

in NEAFC with a completely independent scientific advisor. Ward *et al* surmised that the best approach to the provision of scientific advice would be achieved by a combined approach where a secretariat was responsible for data collection and research, with multinational meetings for stock assessments. They, cited the example of CCAMLR.[879] The same authors wrote that improvement to the scientific process could occur by including the incorporation of industry and NGO input.[880] The analysis in this thesis supports the conclusions of Ward *et al.* While the independence of scientific advice is a key input to its quality, the analysis in this thesis shows that independence is not beneficial if gained at the expense of responsiveness or salience. Therefore, legal arrangements for the provision of science should, in order to ensure the effectiveness of the advice, provide a source of science that is responsive to the decision making body, and only provide as much independence as is consistent with maintaining that responsiveness. This is not to say that all independence can be given up. It is clear that any legal basis for a scientific advisory body must allow for enough independence from the Member States to ensure that the body does not simply become another forum for debate among members, but rather is a gathering of professional scientists from the Member States coming together to work as a body corporate. Here, the term "independence" refers to the science being independent from the political process. This does not mean that the scientific organisation has to be independent from the political organisation, simply that there must be procedures in place to ensure that science is conducted appropriately. Any scientific committee should be created in the Convention, rather than simply by the Commission as CCAMLR, SPRFMO, SEAFO and NAFO are, and certainly should not be left to be created by the Commission as the GFCM does. The Scientific Committee should not just be coordinators of

[879] Ward, Tsirbas and Kearney, above n 346, 11-21.
[880] Ibid, 21-23.

State views; they should have a life of their own, they should conduct their own work and analysis separate from the State, even if the work is done by State scientists.

Lodge *et al* argue that for effective RFMO decision making there is a need for delimited functions even concluding, on the basis of scientific work, that the following functions should be given to scientific bodies:

> • understand and assess issues related to the target species and the broader ecological benefits and impacts of fishing;
> • understand and assess issues related to any non-ecological objectives of the fishing, including, as appropriate, economic and socio-economic benefits and the impacts of fishing;
> • design and implement monitoring and research programs;
> • design appropriate reference points and management strategies;
> • provide stock and broader ecosystem status reports; and
> • assess and report on the probability of achieving management goals, for example achieving targets and avoiding limits, by the application of management options suggested from any source.[881]

The comparisons conducted by this thesis support the views of Lodge *et al*, particularly the comparison of the effectiveness of GFCM compared to the other scientific bodies. That comparison highlights that the key facilitators of independence and scientific function is, firstly, the inclusion of the scientific body in the Convention text itself, and secondly, the scientific body having specific delineated functions that are theirs alone. The delineation of functions serves to ensure that the scientific advisor has functions and powers that cannot be encroached upon or taken away by the decision making body, it ensures that the decision making body has to leave the consideration of science to the scientific body. Additionally it ensures, if the functions are correctly defined, that the scientific body is only asked to provide scientific advice, not asked to come up with objectives or aims, which are best decided by more political bodies. Therefore, for increased

[881] Lodge et al, above n 9, 32.

effectiveness RFMOs should ensure that there are clear guidelines on the roles and functions of the committee and that those must be focused on scientific tasks and should ideally be included in the legally binding convention text. Importantly, this direction should not extend to telling the scientific body how to do science, or what questions should be answered in order to provide the best advice to the decision making body. These questions are clearly best determined by a scientific rather than political assessment of the situation.

Quality Control in the Provision of Scientific Advice

Ensuring that the science provided to decision makers is high quality is important to ensure that it is credible, effective and legitimate. According to FAO the credibility that fisheries science requires relies on having been subject to a process of peer review, internal and external.[882] Additionally, given the need for training and expertise, science can only be quality controlled properly by scientific peers and not by non-scientists.[883] Quality control occurs at a variety of stages in the scientific process; including by having appropriately trained people conduct the science, by having a review process and by ensuring there is transparency in how scientific conclusions are reached.

For CCAMLR, Resolution 31/XXVIII emphasises the key role of the Scientific Committee as the provider of best available science to the Commission and its members (to be preferred over research conducted by individual members). The Resolution encourages members to support the committee by, actively participating in its meetings and programs with real experts, providing it with both the data requested, and with the relevant research.[884] Article XIV (2) of CCAMLR

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882 The Food and Agriculture Organization, 'Indicators to Assess the Performance of Regional Fisheries Bodies', (Second Meeting of FAO and Non-FAO Regional Fisheries Bodies or Arrangments, The Food and Agricultural Organisation, RFB/II/2001/3, 20-21 February 2001) 242.

883 Delegation of the United States to CCAMLR, *Best Available Science,* CCAMLR Resolution 31/XXVIII, 2008, available at https://www.ccamlr.org/en/ccamlr-xxviii/39.

requires that all representatives have suitable scientific qualifications again supporting the quality of the advice that is produced. The same Article at part (3) allows the Scientific Committee to seek the advice of other scientists and experts, again furthering the expertise that can be available for providing scientific advice. There is no specific mention of external or internal peer review but the Scientific Committee produces a number of research papers that are subject to peer review and uploaded on the CCAMLR website. This transparency allows for the critical analysis of at least some of the advice by third parties.

The scientific quality of the advice provided by SPRFMO's Scientific Committee is safeguarded by two provisions, Articles 10 (4) and 10(5). Article 10(4) provides that the Commission can engage scientific experts to provide advice directly to it on conservation or management. This means that if there is doubt as to the quality of the scientific advice provided by the Scientific Committee, or if the committee does not have the required expertise, outside experts can be used to confirm or provide advice. Article 10(5) provides that the Commission will ensure that the advice of the Scientific Committee is periodically subject to peer review. Transparency is aided by Article 23(2) which requires that scientific assessments be made publically available, enabling scrutiny from scientists and other interested parties around the world.

Scientists in SEAFO also have access to outside expertise to supplement their members, however, differently to CCAMLR and SPRFMO, it is the Scientific Committee rather than the Commission which is able to seek out that expertise.[885] Article 10(5) of the SEAFO Convention, requires the Scientific Committee to consider the views of other fisheries organisations and scientific bodies, but, the Convention text contains no other mechanism for peer review or critical analysis by the public.

[885] *SEAFO Convention*, Art 10(2).

The NAFO Convention includes several measures that assist with the quality control of scientific information, including measures to allow critical analysis by interested members of the scientific community or the public. Article VII (9) (b) of the same convention allows the Scientific Committee to cooperate with any public or private organisation. More decisively, Article VII (7) of the Convention requires the Scientific Committee to adopt rules for the participation of observers from NGOs and non-Contracting States, these rules are required to allow for timely access to reports and records.

NEAFC outsources its scientific advice completely to an organisation which is purely scientific and therefore follows the procedures of quality control inherent in the discipline. Paragraph 1 of the NEAFC-ICES MOU states:

> ICES according to this Memorandum of Understanding will provide NEAFC with scientific information and advice, which is [ ] subject to best international quality procedures for research and research based advice. The technical basis for the advice and the process through which it is produced will be transparent and the quality of the technical basis is ensured through internal and external peer review.

This means that NEAFC has access to scientific advice with the highest level of scientific review. Yet even with this high standard the quality of the scientific advice itself was questioned in 2010 by the Russian delegation which argued essentially that the advice was too independent and did not take into account Russian data. Whether this protest was truly for scientific reasons or was a political manoeuvre is difficult to say, but it is interesting that even where science is created in a legal framework which preserves its purity as a discipline to the highest degree, it is not immune from criticism and is not always followed.

Quality control and review mechanisms are one of the key parts of the scientific method; science is based around the ability of results to be reproduced, to be retested and on quality control preserving the clarity of scientific methodology. Science has relied primarily on peer review and reproduction to provide quality control. Thus, when science is published, the scientific work is assessed by other scientists in the field, (peer review), and many scientists around the world spend time attempting to replicate the results of other scientists, to ensure that the results are correct. There must also be quality control for the science used to support fisheries decision making. Lodge *et al* stated that best practice for RFMOs was to ensure that the following was in place:

- There is periodic independent advice and peer review of the assessments, reference points and management strategies. This advice and review is provided directly to both the scientific body and the decision making body of the RFMO, and they are publicly available.

- The advice of the scientific body is publicly available, and includes performance reporting against the target and limit reference points.[886]

The only RFMO examined that has a legally binding system of peer review is NEAFC; based on the ICES-NEAFC MOU. In the other RFMOs there is no mention in the convention text, or other legally binding documents of a review process. In CCAMLR, SEAFO and SPRFMO, there is the ability for either the scientific body, or decision-making body to consult or use outside experts. This would enable review by outside experts, but certainly does not mandate or even encourage peer review. Legal arrangements could further support effective scientific advice by establishing, within conventions, a mechanism for internal and external review of scientific advice on a periodic basis. Additionally, the legal arrangements could mandate that all scientific work which underpins advice to the decision maker is made public (except for cases of commercial-in-confidence data) and this would allow critical analysis of the science and independent assessment of the results and analysis from interested scientists and organisations.

[886] Lodge et al, above n 9, 32.

Decision Making Procedures

Many RFMOs require consensus in the decision making body before management measures can be implemented. Yet, notable reports, such as the Chatham House Report, state that consensus decision making is not best practice as it leads to inevitable deadlock.[887] Consensus might be a common feature in RFMO mandates or practice, but what link does it have with the use of science? Science does not normally strive to provide consensus. Science is inherently skeptical and it is part of the scientific method to always challenge and test currently accepted positions, therefore consensus is not only rare in science it can also be unhelpful. This competes with the legal and political reality of regional fisheries management. Each State party to a RFMO is a sovereign entity and it is not possible to use the law to enforce compliance with regional or international collective decisions, at least in the context of fisheries management. Given the inability to easily force (in the legal sense) States to implement measures, it is left to politics to convince each Member State to implement those measures. The overarching framework of international law lends itself to a requirement for consensus in decision making.

In the subject RFMOs examined consensus decision making was found in CCAMLR and SEAFO. Other RFMOs encouraged consensus decision making as a first choice but allowed for some form of majority decision making where that failed. RFMOs with this structure included: NEAFC (Article 3 (9) of the new NEAFC Convention) and SPRFMO.[888] In GFCM[889] and NAFO[890] decisions were always taken by a vote, with the passing of management measures requiring a two-third majority. (In fact, for political reasons NAFO management measures cannot be implemented without consensus). The comparative analysis in chapter five of this thesis suggests that it is not

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887 Ibid, 40-41.
888 *SPRFMO Convention*, Art 16.
889 *GFCM Convention* (as amended until 1997), Art V.
890 *NAFO Convention*, Art XIV.

possible to contend that consensus decision making impacts adversely on the use of science in decision making, as those RFMOs most effectively using scientific information were also those that relied on consensus decision making. Therefore a legal requirement for decision making procedures other than consensus should not be seen as a prerequisite to the proper use of scientific information.

Non-Science Inputs to Decision making

That clear scientific recommendations of the relevant advisor, or committee, are not always or even ordinarily followed is perplexing given that all RFMO agreements require that decisions made about fisheries management are based on science.[891] Oh found that decision makers said that they trusted the science being provided to them, so at least in that case there must be another reason that scientific advice is not followed.[892] A possible explanation is that non-scientific factors are playing a more key role in decision making. It is a fact that non-scientific inputs are a consideration for decision makers as science is not the only relevant source of information (although it would seem that way from a review of most RFMO agreements).[893]

In many instances taking into account information other that science is key to effective management and the implementation of measures. Peel argued that where science is uncertain, it should rationally hold less value to decision makers. Therefore in cases of high uncertainty, other forms of knowledge: political, economic or social, should be more useful to decision makers.[894] This requirement for other forms of information in the face of uncertain science is also supported by the review of the decision making of RFMOs in chapter five. In particular, CCAMLR was able to make many decisions in the absence of scientific consensus because it was willing to use other

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891 See for example NAFO in years 2006, 2009, 2011 and 2012 in chapter five.
892 Oh, above n 299.
893 McDorman, above n 64.
894 Peel, above n, 66.

sources of information.[895] The converse is also true, RFMOs that do not utilise advisory information other than science will fail to act when faced with scientific uncertainty.[896]

The final example of failure is the inability of a RFMO to come to a consensus even where scientific advice with a high degree of certainty exists. This surely must be a reflection that political, economic or other considerations have outweighed the scientific advice for at least some members of the decision making body.[897] Political or policy reasons were the explicit reason cited by SEAFO as to why it did not follow scientific advice in 2005 (in relation to a freeze on fishing) and 2007 (in relation to a ban on gillnetting).[898] Unfortunately, the legal framework for decision making does not require publication of reasons for departing from scientific advice, so such deviations are not routinely explained.[899]

There are a range of legitimate fields of knowledge that decision makers should consider with determining management measures because "science unaided will never 'solve' the problems of fisheries management."[900] To be able to solve the fisheries problem it is clear that science needs help from: economists who can assist in understanding the motivation of markets and fishermen, sociologists who help understand community motivations and lawyers who help create institutions and procedures to bring this knowledge together.[901] The benefit of including other forms of knowledge in the fisheries dialogue also includes improving scientific advice because unfortunately where factors such as economics or politics are not able to be expressed in the decision making

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895 Where CCAMLR acted in the absence of scientific advice they did so on the basis of the precautionary advice, or continuation of previous measures of TACs (see for example 1985, 1991, 1992, 1993, 1994, 1996, 1997, 1998, 1999, 2000, 2002, 2003, 2004, 2005, 2006, 2007, 2008, 2009 and 2012, chapter five).
896 See for example SEAFO in 2011 and 2012 Skagestad, above n (2011) 728, 5-9;Skagestad, above n (2012) 728, 3-6.
897 Parris, Wright and Cartwright, above n 63, 450-451.
898 Spencer, above n 722, 5; Tsheehama, above n 723, 4-5.
899 See section on SEAFO in chapter 5.
900 Johnston, above n 150, 157.
901 Ibid, 158.

forum then decision makers are forced to justify their decisions on alternate (often allegedly scientific) grounds. This devalues science, as the independence of the science is destroyed by the inclusion of non-scientific factors. If factors other than science can be legitimately used for RFMO decision making, then there will be no need to hide those factors in science and therefore compromise its fidelity. If, as suggested, inclusion of forms of advice other than scientific advice is beneficial to RFMOs, then the legal frameworks that currently support RFMO decision making should plainly be modified to support the use of such disciplines.

Article 2 of *the FAO Code of Conduct* has the objective that fisheries management is to to "[take] into account all the relevant biological, technological, economic, social, environmental and commercial aspects" of fisheries. This is reiterated in Article 6.4 which calls for conservation and management decisions to be based on scientific evidence, but taking into account "traditional knowledge of the resources and their habitat, as well as relevant environmental, economic and social factors". Other multilateral legal instruments do not specifically touch on the use of social or economic factors.

Most RFMO agreements examined do not specifically provide for the role of social and economic sciences, or politics. However, in some cases, for example NAFO the agreement requires that the commission make decisions on the basis of optimal utilisation which incorporates social and economic considerations.[902] The notable exception is GFCM which specifically provides for consideration of both social and economic factors. In Article III(1c) the GFCM convention states that a function of the commission is to "keep under review the economic and social aspects of the fishing industry" and requires that the scientific advisory committee provide advice "including biological, environmental, social and economic aspects".[903] While it is noted that the expertise in

[902] *NAFO Amendments*, Art III (a).
[903] GFCM Convention (as amended until 1997), Art III 1b

many scientific committees would not allow for consideration of economic or social factors it is nonetheless important that they are considered by decision making commissions. The lack of consideration of social, economic and political factors in legal frameworks is translated into RFMO structures. Of the RFMOs examined only GFCM had a standing-body, or even position within the secretariat to advise on the economic and social issues.[904]

It is difficult to say that the lack of consideration of social and economic issues has led to less use of science or poorer decision making (as GFCM followed scientific advice less than other RFMOs), however, the literature on best practice for decision making suggests that it would. The literature cites that the lack of a framework to explicitly consider issues other than science leads to a loss of transparency as decision makers either provide no explanation for their deviation from science, or cloak their reasons in the mantle of science itself.

Transparency and Accountability

Transparency is a lynchpin for improving decision making within RFMOs, without transparency and the accountability that comes with it, other improvements will not be effective. Transparency and accountability legitimise science and decision making, eventually improving compliance through moral legitimacy.[905] The international community has in some cases supported increased transparency with UN General Assembly urging RFMOs to improve transparency and to ensure that their decision making processes are fair and transparent.[906] Not only are decisions viewed as more legitimate when transparent, it has been shown that decisions are better made in an

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[904] General Fisheries Commission for the Mediterranean, *About GFCM*, <http://www.gfcm.org/gfcm/about/en#Org-OrgGovernance> 16.

[905] Bodansky, above n 119, 597-602

[906] Lodge et al, above n 9, 42-43; United Nations General Assembly, Sustainable fisheries, including through the 1995 Agreement for the Implementation of the Provisions of the United Nations Convention on the Law of the Sea of 10 December 1982 relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks, and related instruments, GA Res 61/105, UN GOAR, 71st plenary sess, agenda item 71(b), UN Doc A/Res/61/105, 8 December 2006, para 72

environment of transparency.[907] The Chatham House report on best-practice said that in relation to transparency, best-practice is to have reports and findings subject to periodic independent review, to ensure scientific advice be publically available and that where that scientific advice is not followed, have reasons given by the decision making body.[908] McDorman suggests that a requirement for publication of the reasons for departing from scientific advice (particularly in relation to recommendations that involve specific management decisions, such as setting of total allowable catches (TACs)) would be a key improvement in RFMO decision making.[909]

The *UNFSA* sets out legal standards for transparent decision making in RFMOs. The conference to establish the UNSFA called for improvement in transparency specifically by RFMOs allowing reasonable participation for IGOs and NGOs within the organisations' rules and procedures and in a general way. Article 12 additionally calls for "transparency in the decision making processes" of RFMOs. [910] The multilateral treaties therefore offer little guidance on transparency standards, and how transparency is best achieved, however, the RFMO agreements have given more consideration to the issue.

In Article XXIII of the CCAMLR text it allows the CCAMLR Commission and Scientific Committee to invite observers from a range of organisations including the FAO and other inter-governmental and nongovernmental organisations which can contribute to their work. Part X of the rules of procedure for the CCAMLR Scientific Committee provides for observers to view meetings, but rule 22 allows for any member to require that discussion on a particular topic be

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[907] Ibid, 115-116
[908] Ibid, 116
[909] McDorman, above n 64, 11
[910] Review Conference on the *Agreement for the Implementation of the Provisions of the United Nations Convention on the Law of the Sea of 10 December 1982 relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks*, New York, 22 to 26 May 2006, A/CONF.210/2006/15, paragraph 32(g) of the Annex.

closed. Part VI of the CAMLR Commission rules of procedure also allow for observers but again, rule 33 allows for closed sessions.

The SPRFMO is the only RFMO with an agreement which includes a specific article on transparency, Article 18. In addition to generally requiring transparency, Article 18 mandates that all reports and decisions be made publically available and that meetings be open to observers. Articles 8(1) – 8(6) of the SEAFO Convention likewise allows for observers, requiring the commission to adopt rules of procedure for their attendance it also provides that the rules of procedure cannot be unduly restrictive as they are intended to promote transparency. Unfortunately, rule 35 of the rules of procedure adopted by SEAFO still allows Member States to require that a particular matter be considered in a closed session.

In the 2011 performance review of GFCM no legal basis for transparency was found within the Convention text (although Article XI (4) of the GFCM indirectly indicates an acceptance of observers).[911] The review stated that there was a lack of legal basis for, and guidance for, the participation of observers, particularly from intergovernmental or non-government organisations, although such participation was in fact occurring.[912]

The NAFO performance review also found that the legal arrangements for NAFO lacked transparency measures.[913] The NEAFC performance review found that while there was a legal framework for observers, there were no measures to ensure that observers had access to the information needed to be effective.[914]

All of the RFMOs examined failed to explain why a particular decision was made or why scientific advice was not followed, at least for some decisions. For example, in SEAFO (which has a legal

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911 Swan, Ferlin and Maguire, above n, 38.
912 Ibid, 38 and 80.
913 Hazin et al, above n 523, Executive Summary.
914 Arnason et al, above n 595, 48.

framework for observers) in 2005, 2006, 2007 and 2009 the Organisation created reports which made it very difficult to ascertain what recommendations of the scientific committee were considered by the commission and even more difficult to determine the basis for conservation measures implemented by the commission.[915] In 2008 the SEAFO commission report[916] was restructured to allow for easy comparison between scientific recommendations and conservation measures, however, the change was short lived and the 2009 report[917] returned to the old structure. Where reports were structured to give greater clarity, it was generally done only in relation to scientific advice that had been implemented by decision makers possibly to avoid scrutiny of decisions not following scientific advice, or to avoid inflaming political disagreements where specific States disagreed with proposals. The reports regularly failed to identify those scientific recommendations that were not acted on. For example, GFCM rarely reported discussion of scientific advice that was not acted upon), and rarely did a report provide any reasons why a decision was made against scientific advice.

Transparency in reporting could be the key enabler of better use of science in RFMO decision making. If reports of decision making bodies were required to consider each specific recommendation from the scientific committee and explain their decision on that recommendation, not only would there be more accountability for their decisions, but those decisions would be better.

RFMO agreements for the future

Decision making in RFMOs is primarily based on science and all RFMOs have goals and objectives that support science based management, and all give the primary advisory role to science. Yet,

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915 Spencer, above n (2005) 722; Spencer, above n (2006) 722; Tsheehama, above n 723; Groenhof, above n 727.
916 Tsheehama, above n 723.
917 Groenhof, above n 727.

based on a comparison between the literature on using science in decision making, and current practices in RFMOs, there are changes to legal frameworks that could be made to improve the way that science is used within RFMO decision making. Increased detail within the objectives of RFMO conventions could assist by ensuring that science is not called on to answer political questions. The current level of fidelity does not appear to hinder RFMOs and does offer a level of flexibility that could assist when political consensus on fisheries management shifts. The literature examined also provided that independence was a key enabler of science, but an examination of arrangements in practice found this was not necessarily so. While allowing that it is important for qualified individuals to provide scientific advice, true independence is not so important. It is more important that Member States ascribe a democratic legitimacy to science and that the science provided is responsive to the needs of decision makers in terms of subject, format and timeliness. The risks associated with biased science were more fruitfully countered by those RFMOs that included a process of independent observation, which served to ensure that the science was undertaken properly, while not impacting on the day-to-day delivery.

One area in which it was identified that changes to legal arrangements may assist in the use of science is in the provision of non-scientific advice to decision makers. Currently only GFCM includes an explicit consideration of social and economic factors in its convention and its provision is one of the duties of the scientific committee. These considerations are clearly important to decision makers, particularly when faced with scientific uncertainty, but the current framework discourages the open discussion of social, economic and political reasons for decision. Changes that specifically provided that these were valid considerations for decision making would encourage a more transparent decision making process and would improve the use of science, by ensuring that there was no pressure to influence the scientific process due to these considerations.

It appears clear that the key enabler to better use of scientific information within RFMOs is transparency. Currently, transparency is assisted by the presence of NGO and inter-governmental observers and by the public release of reports. Unfortunately, these are not supported by legal frameworks. One area where legal frameworks could be improved is rules to allow observers to be more effective such as by ensuring access to information. Another area for improvement is the requirements within conventions for the publication of decisions. The publically available reporting should not only include all scientific recommendations, the decisions made on them and the reasons for those decisions (all of which are not always included) and should do so in a structure that makes it easy to compare scientific recommendations and final decisions. These requirements should not be left to the discretion of the decision making body itself, but rather they should be mandated within the legal framework.

Chapter 7

The Ross Sea MPA – A Case Study on the Use of Science in Politically Challenged Decision Making

The Current International Legal Framework for MPAs in Areas Beyond National Jurisdiction

The current international legal framework allows for, but does not encourage, the creation of Marine Protected Areas (MPAs) in areas beyond national jurisdiction. *LOSC* Part XII is devoted to the protection and preservation of the marine environment.[918] In Article 197 it provides that "States shall cooperate on a global and regional basis, directly or through [] international organisations [to develop measures] for the protection and preservation of the marine environment" but does not specifically discuss MPAs.[919] Likewise, Section 2 of Part VII, relating to the conservation and management of marine living resources in the high seas, includes a duty to cooperate (which could be used to cooperate in creating a MPA) but does not specifically include MPAs. Tladi notes several States have expressed the view that the above inclusions within *LOSC* provide a sufficient framework for the creation of MPAs.[920] However, Tladi goes on to summarise with approval the academic consensus that from a practical perspective the current legal framework is insufficient for creating MPAs in response to a degraded marine environment. This conclusion is based on the fact that the marine environment has been continually degraded since the creation of *LOSC* and MPAs in areas beyond national jurisdiction have not been used (with some exceptions in CCAMLR) to combat that degradation.[921]

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918 *LOSC*, Part XII.
919 *LOSC*, Art 197.
920 D. Tladi, 'The Proposed Implementing Agreement: Options for Coherence and Consistency in the Establishment of Protected Areas beyond National Jurisdiction' (2015) 30 *The International Journal of Marine and Coastal Law* 654, 658.
921 Ibid, 659.

Most RFMOs include within their legal framework the duty to cooperate which could arguably include cooperating for the creation of MPAs. Unfortunately, the mandates of many other have significant limitations, either in geography, or in the scope of species managed.[922] This means for many RFMOs it would be outside of their mandate to create a MPA with the broad aim of protecting the marine environment, although they can and do create areas closed to fishing for particular species. CCAMLR has the broadest agreement in this respect as it has a mandate for the "conservation of Antarctic marine living resources".[923] The broad nature of CCAMLRs mandate could potentially support a MPA created for relatively broad conservation aims.

The Future Legal Framework for MPAs in Areas beyond National Jurisdiction

The continued degradation of the marine environment has led to an initiative to develop a specific legal framework for protecting biodiversity in areas beyond national jurisdiction. The initiative, which has built on the work done at United Nations Conference on Sustainable Development led to the recommendations of an Ad Hoc Open-ended Informal Working Group to the United Nations General Assembly to "develop an international legally-binding instrument under [*LOSC*] on the conservation and sustainable use of marine biological diversity of areas beyond national jurisdiction".[924] This recommendation was adopted by the United Nations General Assembly in a resolution.[925] The Resolution from the General Assembly specified that the negotiations for the proposed legal agreement would include MPAs.[926]

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922 Ibid, 664.
923 Ibid, 664; '*Convention on the Conservation of Antarctic Marine Living Resources* 1982' (1982) <http://www.ccamlr.org/pu/e/e_pubs/bd/pt1.pdf>, Art 11.
924 *Letter dated 13 February 2015 from the Co-Chairs of the Ad Hoc Open-ended Informal Working Group to the President of the General Assembly*, UN GOAR, 69th sess, Agenda Item 74(a), UN Doc A/69/780 (13 February 15) Annex.
925 *Development of an international legally binding instrument under the United Nations Convention on the Law of the Sea on the conservation and sustainable use of marine biological diversity of areas beyond national jurisdiction*, GA Res 69/292, UN GOAR, United Nations General Assembly, 69th sess, Agenda Item 74a, 19 June 2015.
926 Ibid, para 2.

The Chair's Non-Paper from the preparatory conference for the negotiations on the proposed agreement sets out the elements proposed for the agreement by various States and other interested parties.[927] The Non-Paper reports that a number of States and NGOs submitted that there should be a clear and transparent mandate for, and process to enable, the designation of MPAs.[928] The Non-Paper also reports that a number of States believe that: the decision for the creation of a MPA should rest with the States parties to the proposed agreement, that the decision should be based on the best scientific evidence (perhaps from a specially formed scientific advisory committee) and that the creation of MPAs should be complimentary to the work of RFMOs.[929] Whether or not a widely accepted legally binding agreement will result from the current negotiations is not yet known, but it is clear that if it does, there will be a dramatic increase in the legal impetus for MPAs in areas beyond national jurisdiction.[930]

CCAMLR's Journey to the Ross Sea MPA

CCAMLR has, for a relatively long time, recognised the need for MPAs to enable the successful conservation and management of ecosystems in the Southern Ocean.[931] In fact, in 2009, CCAMLR established the world's first MPA in an area beyond national jurisdiction with the creation of the South Orkney Islands Southern Shelf MPA.[932] While CCAMLR has a long pedigree for making consensus management decisions based on scientific advice the recent decision to create 'the

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927 Charles, E., *Chair's non-paper on elements of a draft text of an international legally-binding instrument under the United Nations Convention on the Law of the Sea on the conservation and sustainable use of marine biological diversity of areas beyond national jurisdiction,* Ad Hoc Open-ended Informal Working Group to study issues relating to the conservation and sustainable use of marine biological diversity beyond areas of national jurisdiction (28 February 17) available at http://www.un.org/depts/los/biodiversity/prepcom_files/Chair_non_paper.pdf.
928 Ibid, 37-40.
929 Ibid, 40-55.
930 R. Blasiak and N. Yagi, 'Shaping an international agreement on marine biodiversity beyond areas of nationa ljurisdiction: Lessons from high seas fisheries' (2016) 71 *Marine Policy* 210, 214-215.
931 CCAMLR, *Marine Protected Areas (MPAs)* CCAMLR <https://www.ccamlr.org/en/science/marine-protected-areas-mpas>.
932 Ibid.

world's largest MPA' in the Ross Sea[933] was politically divisive and tested the relationship between science, politics and management.

The Scientific Committee's advice on the Ross Sea MPA begins in 2011. At the 2011 meeting it reported that the CCAMLR area should be split into nine domains (including the Ross Sea as Domain 8) in order to develop a representative network of MPAs, and it reported on the initial proposals from the USA and NZ on a MPA in the Ross Sea.[934] The initial proposals were endorsed by the Scientific Committee as being based on the best available scientific advice for the area.[935] The Committee even went so far as to agree that the proposals needed no further debate in the Committee.[936] In the 2011 Commission meeting there was extensive reported discussion on the proposed Ross Sea MPA, with many States supporting the concept but having questions on the detail. For example, Japan requested further scientific analysis on how the restrictions on fishing contributed to the proposed MPA's objectives.[937]

There was no new advice from the Scientific Committee in 2012 but the USA and NZ submitted a new combined proposal to the Commission that they stated was designed to address the concerns raised by other States parties at the 2011 Commission meeting.[938]

In 2013 the Scientific Committee held a special intercessional meeting on MPAs where the revised joint proposal from the USA and NZ was considered.[939] The discussions were extensive with members of the Scientific Committee being able to agree on some, but not all, aspects of the proposed MPA. Some of the concerns raised at the committee meeting were not scientific but

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933 CCAMLR, *CCAMLR to create world's largest Marine Protected Area* (24 Feburary 2017) CCAMLR <https://www.ccamlr.org/en/news/2016/ccamlr-create-worlds-largest-marine-protected-area>.
934 Agnew, above n 695, Annex 6.
935 Ibid, paras 5.45-5.47.
936 Ibid, paras 5.45-5.47.
937 Løbach, above n 696, paras 7.10-7.23.
938 Løbach, above n 698, paras 7.69-7.77.
939 Scientific Committee for the Conservation of Antartic Marine Living Resources, 'Report of the First Intersessional Meeting of the Scientific Committee' (CCAMLR, 11-13 July 2013)

rather went to the objectives and competency of CCAMLR. For example the Chinese delegate questioned whether whales and seals should be considered protection targets in the analysis because they were protected under separate conventions (while at the same time expressing support for the ecosystem approach to management).[940] Likewise Russia raised concerns that the proposed MPA would close areas that were being 'rationally used' by fishing fleets, while leaving open other areas that would be inaccessible to fishing fleets anyway.[941] While such a concern could be based on an assessment that the proposed boundaries would detrimentally concentrate fishing, it appeared in this case to be made on the basis of practical or philosophical concerns, not scientific concerns.

Following on from the intersessional meeting of the Scientific Committee, the Commission also had a special meeting on the MPA proposals.[942] Many States were supportive of the proposal, noting that the Committee had stated it was based on the best available science.[943] However, a number of States did not support the MPA and couched their concerns in terms of science. For example: Russia stated that the meeting of the Scientific Committee meeting was not conducted in accordance with the rules of procedure, Norway stated it supported MPAs but that there was not enough scientific evidence to support some aspects of the specific proposal and Ukraine stated that in fact the Scientific Committee had not made a recommendation to the Commission and that it did not agree that the proposals were based on the best scientific evidence.[944] Interestingly, the Ukraine delegation also expressed the view that the current legal regime under *LOSC* did not allow for the establishment of MPAs in the High Seas.[945] It is clear from these discussions the science

940 Ibid, para 2.10.
941 Ibid, paras 2.12-2.14.
942 CCAMLR, 'Report of the Second Special Meeting of the Commission' (CCAMLR, 15-16 July 2013).
943 Ibid, paras 3.15, 3.16, 3.22, 3.28, 3.32, and 3.33.
944 Ibid, paras. 3.18, 3.23 and 3.26
945 Ibid, para 3.26.

underpinning the proposed MPA (in certain areas of high value fisheries) was in dispute as was the process and integrity of the Scientific Committee.

The Ross Sea MPA was discussed again later in 2013 at the regular meetings of the Scientific Committee and Commission. At the Scientific Committee meeting the sub-group working on the issue reported that the proponents were very responsive to the scientific concerns raised at the intersessional meeting and there was support for the scientific elements of the proposal.[946] In response Russia stated that it maintained its concerns from previous meetings but noted the positive improvements in the proposal such as the 41% reduction in the prosed size for the MPA.[947] At the Commission meeting many members supported the proposal noting that it was based on the best available science, but other members, notably Russia, remained concerned.[948]

Neither the Scientific Committee nor the Commission considered the proposed Ross Sea MPA at their 2014 annual meetings. However, at the 2014 Commission meeting Japan noted that discussions on MPAs at the Commission had been confused and recommended the adoption of a set of criteria for their establishment generally. The proposal was for a type of pre-determined decisions making, by setting out the criteria, which, if met, should lead to the adoption of a MPA by the Commission.[949]

In 2015 the Scientific Committee reported briefly on work showing the impact of sea ice on fishing in the area covered by the proposed MPA.[950] At the meeting of the Commission the USA and NZ introduced a revised proposal for the MPA that further reduced the general protection zone in certain areas.[951] Russia reiterated its concerns that the proposed MPA had boundaries which were

946 Jones, above n 699, para 5.46.
947 Ibid, paras 5.47-5.48.
948 Dybiec, above n 700, paras 7.12-7.19.
949 Dybiec, above n 702, para 5.78.
950 Jones, above n 703, paras 5.26-5.27.
951 Gonchar, above n 704, para 8.41.

larger than required to meet the stated objectives and that the level of Toothfish catch proposed from the special research zone was too low.[952] China stated that it had concerns with the proposal but was willing to negotiate with the proponents.[953] The Antarctic and Southern Ocean Coalition (an NGO observer) noted with frustration that the proposal followed a decision of the Commission to establish a representative network of MPAs and had well established science underpinning it, yet had not been passed even after the area of the proposed MPA had been reduced over four meetings.[954] Russia and China continued, throughout the 2015 meeting, to express the view that more science was needed to support the establishment of a MPA and that there was little need for a MPA where fisheries were already well managed.[955] Many other States parties expressed frustration at the attitude of Russia and China, for example the UK which noted that it found it "difficult to find new ways to express the disappointment of [the UK] delegation" at the continued, year after year, disagreements on the creation of MPAs, even after the Commission decided to create a representative network of MPAs.[956] The Commission report, however, makes it clear that negotiations on the proposal were going on between the proponents and China/Russia in the background, and that by the end of the meeting a compromise had been reached which was acceptable to China but not to Russia.[957] While it is not clear exactly what the behind the scenes negotiations entailed, it is apparent that it did not involve the procurement of new scientific evidence.

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952 Ibid, para 8.47.
953 Ibid, para 8.51.
954 Ibid, para 8.52.
955 Ibid, paras 8.88-8.90.
956 Ibid, para 8.104.
957 Ibid, paras 8.107-8.122.

In 2016, the Scientific Committee did not discuss the proposed Ross Sea MPA.[958] But at the October Commission Meeting, the USA, NZ and Russia announced that negotiations between meetings of the Commission had led to a revised proposal that was acceptable to the proponents and to Russia. This meant a conservation measure for the creation of the Ross Sea MPA (CM 91-05 (2016)) could be adopted.[959] Russia described the revisions as a win for science, by allowing more scientific (fishing) data to be collected and thus supporting decisions to be made on the basis of 'sound science'.[960]

The Effectiveness of the use of Science in MPA Decision Making in CCAMLR

The CCAMLR process to create a MPA in the Ross Sea highlights the limitations of science as a basis for decision making in situations where important economic, political and diplomatic issues are at stake. It is apparent that the original proposal (2011) as well as the first revised proposal (2012) to create a MPA were based on the "best available science". In both cases the Scientific Committee stated that the proposal was based on the "best available science", the key criteria for the making of conservation measures within CCAMLR.[961] In any event it is clear that from 2014 (two years and two revisions before the MPA was adopted) onwards the disputes over the proposed MPA were not based on science as the Scientific Committee ceased substantive discussions on the proposal from that time.

The reasons given by many States parties for not agreeing with the MPA proposals were regularly couched in scientific terms. States criticised the procedure for creating the science (such as Russia arguing that the meetings of the Scientific Committee did not follow the appropriate rules of

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958 M. Belchier, 'Report of the Thirty-fifth Meeting of the Scientific Committee - Preliminary Version' (CCAMLR, 17-21 October 2016).
959 V. Titushkin, 'Report of the Thirty-fifth Meeting of the Commission' (CCAMLR, 17-28 October 2016), paras 8.37-8.40 and 8.48.
960 Ibid, para 8.40.
961 Agnew, above n 695, paras 5.45-5.47.;

procedure) or disagreed that the Scientific Committee discussions and recommendations were as recorded in the report (as was the case with the Ukraine).[962] Others simply argued that there was not enough science on which to base the decision to create a MPA (an easy claim to make in the face of ever present scientific uncertainty). The also argued that the MPA, by providing for conservation, would not allow for enough scientific fishing research to be conducted.[963] The States who supported the MPA also argued from the basis of science, using the continual refrain that the proposal was based on the best available scientific evidence.[964]

The changes requested by the States opposed to the MPA suggest concerns other than the strength of the science. First, it is clear that many were concerned about restricting access to areas where their fishing fleets caught valuable Toothfish in a way that they believed to be sustainable and so they sort to revise the boundaries of the 'no take zone' to limit that impact.[965] The same concern was apparent when some States wanted to increase the level of scientific catch available.[966] States also seemed concerned about creating a conservation measure that would be difficult (due to the requirement of consensus decision making) to reverse. This was particularly apparent with the desire of many States to put in place a sunset clause for the MPA.[967] Finally, States appeared concerned about setting a precedent for the creation of large-scale conservation MPAs. This can be seen in the early complaints that the area was already successfully managed and that the area covered by the MPA was larger than required by the objective of 'rational use' within the C*CAMLR Convention*.[968]

[962] Scientific Committee for the Conservation of Antartic Marine Living Resources, above n 939, paras 3.18, 3.23 and 3.26.
[963] Jones, above n 699; Jones, above n 703.
[964] Jones, above n 703, paras 3.15, 3.16, 3.22, 3.28, 3.32, and 3.33.
[965] Jones, above n 699, paras 2.12-2.14; Gonchar, above n 704, para 8.47.
[966] Gonchar, above n 704, para 8.47
[967] See for example Titushkin, above n 959, paras 8.37-8.40 and 8.48.
[968] Jones, above n 699, paras 2.12-2.14 and 5.47-5.48.

Economic, political and diplomatic issues were a concern for several States, but they raised these concerns couched in scientific terms in both the meetings of the Scientific Committee and the Commission. In 2014 there was the apparent realisation that diplomatic negotiations, rather than more science, was required, and thus the reports from those years allude to meetings between the proponents of the MPA and those States opposed to it on the sidelines of CCAMLR meetings and intersessionally. While it is laudable that these discussions led to the creation of a MPA it is disappointing that they could not occur transparently within the meetings of the Commission. This appears to be a result of the desire to base all decision making at CCAMLR on the basis of science, with States unwilling to formally say that they accept the science and disagree with economic/diplomatic/political factors. That these factors will impact on the decision making of States is undeniable and therefore they should be included in the Commissions deliberations.

The discussions at CCAMLR also demonstrate the ability of States who disagree with a proposal (for any reason) to disparage it under the guise of science. The uncertainty inherent in science, as well as the tentative language used by scientists, means that it will always be possible to point out limitations with scientific advice. Where States determine that they do not support a proposal, they can always easily argue against the science or argue that there is not enough science.

Finally, the discussions in the Scientific Committee show the difficulty of excluding political, diplomatic and economic discussions from scientific discussions. Although States send scientists to participate in scientific meetings, they send them immersed in the domestic concerns of the State. This demonstrates the importance of being able to have economic and political discussions at a forum outside of the Scientific Committee. It is possible that if CCAMLR had an economic/social issues advisory body, that those issues could be discussed there instead of in the Science Committee.

The Legal Regime and CCAMLRs MPA Decision Making

The process to create the Ross Sea MPA was difficult, despite the fact that: CCAMLR had determined that they should create a representative network of MPAs, they had divided the CCAMLR conservation area into representative areas, the Scientific Committee had stated that the proposal was based on the best available science and they had even created a MPA before. It is clear that political, economic and diplomatic factors had a role in this difficulty, but it is possible that changing the process could have minimised the problems.

The Japanese delegate noted that they thought the problem was that general criteria for the creation of MPAs had not been created.[969] It was their belief that if there were a set of criteria established for the creation of MPAs in general, then the creation of specific MPAs would become easier. In essence they were advocating for a pre-determined principle based approach to the creation of MPAs. Evidence from CCAMLRs own history of decision making supports the benefit of this approach. In the past, CCAMLR has used pre-determined criteria to successfully pass conservation measures for valuable stocks.[970]

The ongoing work on a legal framework to protect biodiversity in areas beyond national jurisdiction may offer a solution to this dilemma by either creating the general criteria required of or by giving impetus to RFMOs to create their own criteria. The proposed implementing agreement, if it contains the features currently envisaged by the preparatory conference on negotiations, would include not only a mandate for the creation of MPAs but criteria and a clear process for their creation.[971] It appears from CCAMLRs experience that the enunciation of these

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[969] Dybiec, above n 700, para 5.79.
[970] Constable, above n 625, 235.
[971] Charles, E., *Chair's non-paper on elements of a draft text of an international legally-binding instrument under the United Nations Convention on the Law of the Sea on the conservation and sustainable use of marine biological diversity of areas beyond national jurisdiction,* Ad Hoc Open-ended Informal Working Group to study issues relating to the conservation and sustainable use of marine biological diversity beyond areas of national jurisdiction

criteria and a process in international law would minimise some of the problems that RFMOs have in discussing and creating MPAs.

The discussions on the Ross Sea MPA show that even in situations with many political, economic and diplomatic factors at the forefront, States feel the need to voice their objections in terms of science. The use of science as the single input into RFMO decision making is counter-productive when it simply cloaks the true reasons for a State's position and forces negotiations to the sidelines. It is clear that States will never fully yield to scientific advisors and will always consider other interests and perspectives. It is important for RFMOs to be open about including these inputs in their decision making. If the CCAMLR legal framework specifically allowed for the consideration of economic, political and diplomatic concerns it would give parties licence to discuss these in the Commission without cloaking them in science. The benefits of this would be two-fold. First, it would help ensure that those factors were not aired in the discussions or recommendations of the Scientific Committee, insuring the scientific integrity of that advice. Secondly, it would allow for more transparent discussion to occur within the Commission itself, rather than on the sidelines, thus improving the transparency of decision making processes within the RFMO.

The decision by CCAMLR to create a large MPA in the Ross Sea, after years of negotiation, is a great testament to the ability of RFMOs to enact conservation measures grounded in, if not completely based on, scientific advice. It also provides the opportunity for other RFMOs and those participating in negotiations for the proposed implementing agreement to learn what factors assist in fostering a decision making environment which allows conservation measures such as MPAs to be enacted. If those lessons are learnt it will improve the ability of all RFMOs to create effective conservation measures grounded in scientific advice.

(28 February 17) available at
http://www.un.org/depts/los/biodiversity/prepcom_files/Chair_non_paper.pdf 927, 40-55.

Chapter 8

Conclusions

Marine capture fisheries have long been a source of sustenance to humanity and they have grown in importance as a source of nutrition alongside our ability to exploit the oceans. Unfortunately, in recent decades our ability to harvest the ocean has outgrown the productivity of marine ecosystems. This change means that the ability to sustainably manage global fish stocks has increased in importance. Today, RFMOs (which have the responsibility for managing many of the fish stocks on the high seas), have the important task of ensuring that the oceans continue to be productive for generations to come.

The Importance of Studying the Effect of Legal Structures on the Use of Science in Decision Making within RFMOs

RFMOs rely on science to assist them in making the right management decisions. Science assists decision makers to answer 'basic questions' like: What are the fish? How many fish there are? Where are the fish? When to fish? and What else eats the fish?. Science also assists decisions makers to understand the possible answers to more complex questions such as how populations of fish will respond to different management decisions. The marine environment is inherently uncertain and fluctuates through seemingly random cycles and our current methods of management cannot provide all the answers required to manage fisheries with certainty. Yet science remains the key method for understanding fish populations and the effect that management decisions will have on them. The legal framework confirms this position. Thus, multilateral treaties relevant to fisheries, and the legal arrangements for individual RFMOs clearly place science at the centre of decision making. Looking at the whole legal framework it could be assumed that fisheries managers would always follow scientific advice when it was available. But this is not the case. Both the literature on the topic and the research undertaken for this thesis show that decision makers do not always, or even often, follow scientific advice. In some cases making a decision based on factors other than science is important, for example where the science is uncertain, or scientific advice is not provided at the necessary time, but in cases where there is scientific advice it is not prudence but politics or policy that leads to it being ignored.

The integration of science into decision making within RFMOs faces a number of challenges: the perceived bias and non-independence of scientific advice, undue influence of external factors, poor communication, a lack of responsiveness or timeliness, a lack of legitimacy, a lack of relevance, and limited pathways to include other forms of knowledge. It is one role of the legal framework to overcome this difficulty and to facilitate the effective use of science in decision-making. The literature examined in this thesis has highlighted a number of ways legal frameworks could improve integration. First it has been shown that science should not be asked to make political decisions, such as what the goal of fisheries management should be. Secondly, it has been shown that the use of science is improved when the creation of science is more transparent and independent thus increasing the legitimacy of science. Thirdly, it has been shown that science is an uncertain, rapidly developing discipline and therefore needs to be allowed to change over time. Finally it has been shown that other forms of knowledge both expert (politics, economics, social science and behavioural science) and non-expert (stakeholder and community views) must be incorporated into decision-making. These factors are relevant to understanding fish stocks and fishing practices, and RFMOs ignore these factors at their peril. It appears, given the divergence of decisions from scientific advice, that often these factors are considered, just non-transparently, clocked in disagreement with, or unexplained divergence, from scientific advice.

Fisheries decision making requires many disparate streams of information and knowledge merging to form a coherent voice to manage a common resource. For RFMOs to manage fish stocks in a way that continues to provide sustainable fish products they need to be effective at integrating scientific information into decision making. This can, and does, occur without the need for modification of legal frameworks. However, integration is a foundational role of the legal frameworks underpinning RFMOs, therefore, the modification of legal frameworks to support better integration will assist in ensuring that improvements are consistent across the different RFMOs (as the changes are adopted) and consistent through time (rather than reliant on particular political circumstances).

The Methodology of this Thesis

This thesis examined decision making across six multi-species RFMOs, CCAMLR, SEAFO, SPRFMO, GFCM, NAFO and NEAFC. The methodology used was to first examine the publically available reports from the scientific advisory body within each RFMO to determine what the scientific advice was and which recommendations were provided to the commissions. Following this, the publically available records of the decision making body were examined to see whether or not the decisions made followed or deviated from the scientific advice. The records of decision making also occasionally indicated why scientific advice was not followed and, by absence, an understanding of when scientific recommendations were not even considered by decision makers. The RFMOs were then compared to determine which features of RFMO; legal arrangements, policy, or structure, contributed to differences in the use of science and effectiveness of decision making. This method was used as it allowed the effect of differences in legal frameworks to be examined. Earlier studies, such as that conducted by Oh into IAATC, focused on one RFMO and used interviews to determine what factors had an impact on the use of science in decision making.[972] The method used by Oh was not used in this thesis because it cannot be used to isolate differences caused by variations legal frameworks, structures, policy and practice. However, the

[972] Oh, above n 299.

examination of individual RFMOs using interviews or other similar techniques could assist in determining the validity or otherwise of the findings in this thesis by understanding more clearly the differences between the realities of decision making processes and the public reporting of those processes.

The Differences in Current RFMO Legal Arrangements and the Effect on the Use of Science

The legal arrangements for all the RFMOs examined required that decision making be based on scientific advice, yet, none of the RFMOs examined automatically implemented specific scientific recommendations as conservation measures. Therefore it is clear that a requirement in a legal framework for decision making to be based on science is not a sufficient or complete solution. Legal frameworks must create an environment conducive to the effective use of science rather than simply mandating it. This is especially important because decision makers also invariably found it difficult to make decisions in the absence of scientific consensus. So while decisions were not always in accordance with scientific advice, where there was no scientific advice paralysis sometimes occurred. This is not conducive to effective fisheries management because fisheries science is inherently uncertain and in any process where scientists are asked to advise on natural systems it is likely there will at times be a lack of consensus or even insufficient information for any scientific advice to be offered. In times such as these decision makers are not well served by waiting for a scientific consensus that may never arrive, but rather, should act based on other sources of information. A legal regime that more rigidly enforces the requirement for decisions to be based on scientific advice could be counter-productive.

In previous comparisons of RFMOs CCAMLR has been singled out as an example of best practice.[973] The analysis within this thesis agrees with that assessment, and found that out of all of the RFMOs examined, CCAMLR regularly enacted conservation measures based on scientific recommendations. NAFO and SEAFO also both regularly (but less so than CCAMLR) acted on the advice of their scientific advisor(s), but on difficult issues (such as TACs relating to commercially important species), they sometimes implemented measures that were contrary of scientific advice. Both RFMOs also had difficulty implementing measures in the absence of consensus in the scientific committee. NEAFC and GFCM did not regularly implement measures based on scientific advice and often failed to consider scientific advice. In relation to SPRFMO, there was not yet enough reporting to draw strong conclusions, but in early meetings all of the recommendations of the scientific committee were adopted as conservation measures.

By comparing the legal frameworks, structures and practices of the RFMOs that regularly enact conservation measures based on scientific advice, to those RFMOs which did not, a number of inferences can be drawn about how legal structures may better support effective integration of science into decision making.

A comparison of NEAFC to other RFMOs allows an analysis of the importance of independence of the scientific body to the decision making body. NEAFC employs ICES to provide independent scientific advice. The literature suggests that science is best created in an environment of independence in order to insure that its conclusions are not tainted by political or other considerations.[974] A legal framework that creates complete independence for the scientific body would theoretically allow for the highest quality, unbiased scientific advice to be created. This framework exists in NEAFC with ICES, a completely independent organisation, providing advice

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973 Lodge et al, above n 9, 139.

974 See the discussion at page 55 of this thesis.

on the basis of the ICES-NEAFC MOU. Yet, NEAFC does not regularly implement scientific recommendations into conservation measures. The problem with the relationship between NEAFC and ICES appears to relate to responsiveness and salience, advice is not provided at the right time, in the right form, or on the right questions to allow decision makers within NEAFC to utilise it effectively. It appears that the responsiveness and salience of advice is more important to effectiveness than achieving absolute independence. From this is it can be deduced that any structure for the provision of scientific advice should be attuned and subservient to the relevant decision-making body, at least to such an extent as to provide advice at a time and place that will allow it to be used by the decision making process, even where this may lead to deviations with scientific best practice.

This is not to say that all independence could be removed from scientific advisory structures without adverse consequences. In CCAMLR, SPRFMO, SEAFO and NAFO there is a level of structural independence between science and decision making that ensures that the science body is not simply another political body. This suggests that what is actually important is the independence of the scientific process from the political process. It does not mean that the scientific organisation has to be independent from the political organisation, simply that there must be procedures in place to ensure that science is conducted appropriately. Indeed there are benefits in the utilisation of national scientists in scientific advisory bodies, their participation adds to the democratisation of the scientific advice, ensuring that all views and sources of information are considered. Importantly, scientific advice produced in this, more inclusive way, has greater legitimacy as States have had a role in creating it, and it will be more difficult for political decision makers to ignore it.

From analysing CCAMLR, SPRFMO, SEAFO and NAFO the following structural features appear important to ensuring effective and salient scientific advice without sacrificing the quality of that science. First, the scientific advisory body should be created in the Convention, rather than by the decision making body itself. Secondly, the legal or policy framework should ensure that the scientific advisory body does not just coordinate the scientific views of the Member States, but rather provides its own advice as a scientific body. Thirdly, there must be some form of opportunity for independent review or critique of scientific advice, although there is no evidence for the benefits of any specific form of review mechanism.

Quality control and review mechanisms are one of the key parts of the scientific method; science is based around the ability of results to be reproduced, to be retested and on quality control preserving the clarity of scientific methodology. Science has relied primarily on peer review and reproduction to provide quality control, these processes allow other independent scientists in the field to assess the work. Lodge *et al* stated that best practice for RFMOs in relation to review mechanisms was: "periodic independent advice and peer review of the assessments" and making sure that the "advice of the scientific body is publicly available".[975] The MOU between ICES and NEAFC provides that all scientific advice would be subject to peer review but this has not necessarily led to more effective use of science. In the other RFMOs there are no peer review processes created within the legal framework. However, in CCAMLR, SEAFO and SPRFMO, there is the ability within the framework to consult or use outside experts, thus allowing periodic independent review if desired. Additionally, in CCAMLR, SEAFO, NAFO and SPRFMO all scientific advice, and the work which underpins it, is made public as a result of either a specific requirement in the legal framework, or through developed practice. Public release allows critical analysis and peer review of the science and replication of the results from interested scientists and NGOs. The effectiveness of scientific advice in both CCAMLR and SEAFO would tend to suggest that a formal mandated requirement for peer review is not necessary for effective use of science,

[975] Lodge et al, above n 9, 32.

but that legal frameworks should mandate the public release of scientific advice (and its underpinning scientific studies) to ensure that appropriate independent review and critique occurs.

GFCM, like NEAFC, often failed to implement or even discuss scientific recommendations. Unfortunately, GFCM did not report on the considerations around scientific advice that was not implemented into conservation measures, but, by comparing GFCM with the other RFMOs some interesting differences can be identified. First, in GFCM, the scientific advisory body was not created by the Convention text, but rather by the decision making body. This arguably could have an impact on the independence, or the perceived independence, of the scientific advice from the political decision making process. Another striking feature of GFCM was that the scientific advisory body also had responsibility for economic and social advice, rather than being purely scientific as in other RFMOs. The literature examined for this thesis clearly identified that the inclusion of inputs other than science was important for any decision making process. The inclusion of forms of knowledge other than science was especially important so as to ensure that these factors were not merely hidden in, or cloaked with science, as this would devalue the scientific input. Therefore the method of including non-scientific factors within GFCM is sub-optimal because it conflates the scientific and other factors, not providing the delimitation the literature suggests. The delineation of functions serves to ensure that the scientific body is only asked to provide scientific advice, not asked to come up with objectives or aims which are best decided by more political bodies. While asking the scientific body to include economic and social science advice does accord with some best-practice guidelines in literature it does not appear conducive to effective use of science in decision making within RFMOs. Therefore economic and social science advice should be available to the decision maker, but through a body other than that which provides scientific advice. In summary for increased effectiveness in the use of science, RFMOs should ensure that there are clear guidelines on the roles and functions of the scientific advisory body, those functions must be focused on scientific tasks (to the exclusion of other tasks) and all of this should be included in the foundational legal agreement. Importantly, these clear guidelines should not extend to telling the scientific body how to do science as this is best determined by a scientific rather than political assessment of the situation.

The use of Science in the CCAMLR Decision to Create a Ross Sea MPA

The case study of the CCAMLR decision to create an MPA in the Ross Sea illustrated the importance of non-science inputs into the decision making process. The eventual decision to create the MPA occurred two years after the Scientific Committee had agreed that the proposal was based on the best available science and had stopped substantive discussions on the matter. In the end the proposal was agreed only after diplomatic negotiations occurred outside of the Commission meetings. It is clear that non-science issues, such as economic or domestic politics will always be relevant to the way States approach decision making at RFMOs. The reluctance of States to discuss this matters within the meeting of the Commissions is unfortunate as it lessens the transparency of decision making and arguably the effectiveness of the decision making process. To improve this RFMO legal arrangements should specifically allow for consideration of these non-science issues and possibly create an advisory body to provide advice to the decision makers on them. It was also suggested by the Japanese delegation that using pre-determined decision making, that is setting criteria for the creation of MPAs in general would improve the ability of decision maker to take a principled approach to decision making on specific MPAs. This type of decision making has worked in the past for CCAMLR (in relating to krill), is supported by literature and may be a useful strategy for RFMOs to adopt.[976]

[976] Constable, above n 625, 235; Lodge et al, above n 9, 26-43.

Structural features of RFMOs that appear conductive to the effective use of science

Not all of the differences between RFMOs can be attributed to variation in the legal arrangements. There were many apparent differences in structure, practice and policy that while not formally included in the legal framework, appeared to impact the effective use of scientific information. Understanding the structural, practical and policy difference allows for identification of features that could be included in future legal frameworks in order to facilitate effective use of science in decision making.

One feature that appears to be key is the ability of decision-makers to make decisions in the absence of scientific consensus. For example, due to the complexities of marine ecosystems, fisheries science can be inherently uncertain and there can be valid disagreements as to the state of a fish stock or the factual outcome of a particular management strategy. This means that there will be times when there is no consensus among scientists or even no ability to offer scientific advice. It is important that decision-makers can still make decisions under these circumstances. CCAMLR has routinely enacted measures in the absence of scientific advice or scientific consensus. CCAMLR achieved this both through the use of the precautionary principle and by the use of risk management decision making taking into account available information. Interestingly, of the RFMOs examined, none claimed to base decisions on political, economic or social considerations in the absence of scientific advice. It appears that the most common methodology throughout the RFMOs was to rely on either the precautionary approach to management or more commonly simply to continue the status quo of previous measures. This identifies two important areas for legal frameworks to consider, the first is the precautionary approach (which is included in newer agreements), the second is that legal arrangements could and arguably should allow avenues for economics and social science to influence decision making.

Another feature that can be discerned as being conducive to the effective use of science is transparency. Currently, across all RFMOs, transparency is assisted by the presence of NGO and inter-governmental observers and by the public release of reports. Unfortunately, these measures are not always supported by legal frameworks. Changes to the legal frameworks of RFMOs to allow observers to be more effective, would ensure that not only were they present but that they could effectively participate. One of the most striking differences between the RFMOs that were most effective at using scientific advice and those who were least effective was the transparency provided by public reporting. CCAMLR in its public reports clearly, though not perfectly, articulates the scientific advice to the decision-making body and the final decision on that advice. This gives political pressure for the consideration of each piece of scientific advice and forces decision-makers to discuss and explain any departure from it. Conversely in GFCM and NEAFC it was both difficult to determine what scientific advice was given, and whether or not it was considered by the decision making body. The reporting also did not discuss scientific advice that did not lead to conservation measures. This style of reporting does nothing to improve decision-making and makes it difficult to critique decision-making bodies when they decide to ignore scientific advice. To improve the effectiveness of how science is used in RFMOs there should be requirements within legal frameworks for the publication of reports from both scientific advisors and decision makers. The legal frameworks should also mandate that reporting include all scientific recommendations, the decisions made on them, and the reasons for those decisions. The framework should also encourage reports to be written in such a way as to make comparisons between scientific recommendations and final decisions easy, thus ensuring that there is political pressure for thorough consideration of scientific advice.[977]

[977] It is noted that in nearly all RFMOs reporting from more recent years is formatted in a significantly clearer and more transparent way than earlier years.

The future of RFMO legal frameworks

RFMOs have an important role to play in managing the fish stocks of the oceans and if they carry out their functions well, those stocks will continue to provide nutrition and employment to large numbers of people for generations to come. It is important that RFMOs are required to periodically review and assess their own performance in order to understand how well they are carrying out their functions and how they may improve. However, it is perhaps more important that the performances of RFMOs should continue to be compared. Comparisons between RFMOs allow those features that are conducive to improved performance to be identified and, hopefully, adopted by other (all) RFMOs.

This thesis has aimed to compare RFMOs to identify features that could be usefully included in the legal frameworks of RFMOs in order to improve their performance in one key area: the effective use of scientific advice. It is hoped that as RFMOs continue to develop they will pay greater attention to the relationship between scientific advisors and decision makers, and perhaps by updating their legal arrangements in order to incorporate greater transparency, and greater inclusion of the economic and social sciences, they will be better placed to manage fish stocks in the face of future challenges.

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